THE IRON TRADE REVIEW

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THE IRON TRADE REVIEW.

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CLEVELAND, O., JUNE 11, 1891.

THE WEEK IN IRON CIRCLES.

General Features. A rather significant "straw" in the trade wind is the fact that car companies are at last beginning to purchase more freely. They state that in making bids for furnishing cars to-day they are asking more than was named thirty days since, and sales are being effected, though no large transactions have been reported. The feeling is, that the coming thirty days will show increased demand for cars at higher prices than have been ruling, and that the long-continued policy of not buying or repairing cars on the part of railroads will change to increased activity, owing to the heavy demand to move the crops, and that all car companies will have until Fall what business they can turn out. To offset this is the prevalent feeling among consumers of pig iron that the end of the coke strike means a large addition to output, and that this will prevent an advance, if not cause actually lower prices. This keeps back the large buying movement that might naturally be expected to follow a long period of light purchases. Whether this is a wise course to pursue remains to be seen. At Cincinnati there has been a fair run of orders during the past week, some of them for extended deliveries. Contracts running to the end of the year are usually made at about twenty-five cents per ton above prices for immediate or early delivery. A recent trip, by our Cincinnati correspondent, through the South, shows unusually light stocks at all the leading furnaces. The average at the twenty-seven stacks in the Birmingham district is below one thousand tons each, while forward sales will likely aggregate 150,000 tons. There has been no change in prices in Southern iron; grey forge for long deliveries selling at $10.25, with opportunities arising to buy for prompt shipment at $10, cars, Birmingham, though no large blocks. The leading companies are heavily sold; one of the largest reports having orders booked for 73,000 tons, and a number of others in proportion to their capacity have sold an equal amount. The Louisville market has ruled quiet during the past week, with no transactions of especial note. Inquiries have mostly run for deliveries beginning thirty or sixty days hence, and some trades have developed, while others are still pending. The trading has been fairly well divided between coke and charcoal metals, and prices show about the same variations that have been reported for some weeks past. The Chicago market shows somewhat of a lull after the heavy buying which was done during the month of May, many of the large consumers having covered their requirements for iron six to twelve months ahead, good sized inquiries, however, are still coming in, showing a liberal amount of business is still pending. As to prices, Southern coke irons are firm and the furnaces of the Chicago district are indisposed to make contract for long deliveries, wanting special figures when such deliveries are insisted upon. On Northern iron, both coke and charcoal, prices remain practically unchanged. In the Detroit market several inquiries for round lots of Southern and Ohio irons have been received, and a number of smaller sales made. Prices for these grades of metal remain firm, although there have been no advances made. Some good-sized orders for Lake Superior charcoal have been taken at figures that have ruled for the last few weeks, and inquiries for a considerable tonnage, covering in some cases a whole season's supply, were received, which will, no doubt, result in still larger sales during the coming week, showing, as stated in our last week's report, that buyers are becoming convinced that the market can go no lower, and that the present is as favorable a time to buy as they will have during the year. Our advices from Buffalo are to the effect that the light supply of iron is becoming more pronounced as time passes, with only a few additions to the active list of furnaces and consumers exhausting their accumulated stocks. A slight increase in the consumption of pig iron is noted, but not enough to make a genuine activity. Prices remain unchanged out of sympathy with the quiet of the trade. Conditions are such that the few Northern furnaces in operation tributary to the Buffalo market could readily realize a half dollar more on their product for prompt shipments, if it was deemed wise to make an advance in the face of a demand which, ordinarily, would be considered light.

The Local Situation. The recent enormous sales of iron ore seem to have taken the edge off the market, and while the active selling continues, there is a noticeable shrinkage in the amounts of the transactions reported. The producers have not yet seen their way clear to increase their working forces, and no improvement can be reported in that direction. The profit margins on ore are so very slight, this year, that quite a good many of the producers, who are favorably situated with regard to markets, are evidently unwilling to rob their mines for the pleasure of doing an unprofitable business, and so are either doing nothing at all, or else are cutting down their production to the lowest possible notch. No improvement has been made in the dock strikes, at Cleveland and Ashtabula, and a large portion of the ore fleet is tied up, unable to unload their cargoes. The Pittsburgh market and the two valleys depend so largely on the Cleveland and Ashtabula ore supply, however, that unless the strike is soon broken, the furnaces who have only just started into blast again, may be compelled to stop, for want of ore. The vesselmen are not seriously inconvenienced—those of them who run wild—because a scarcity of ore, a little later on, would have the effect of driving up lake freights, while those whose boats are chartered for the season sustain no loss because of the laying off of all crews during this enforced season of idleness. Barring this temporary obstruction to trade, the prospect for the pig iron business is a very good one, although the furnaces may not realize any immediate improvement. The stocks of iron have been running very low, and the bulk of the heavy buyers will be ready to enter the market very shortly. Indeed, what iron has been covered during the past week or ten days, was engaged by large consumers, and most of the furnaces have engaged their product, in part, for several months ahead. It follows that the late comers, being in most instances compelled to take the remainder of the productive capacity of these furnaces, will meet a much firmer market, with all that the expression implies. To be sure, the price of iron is still exceedingly low, Bessemer realizing little more than fifteen dollars net at the furnaces, but it is believed that this price does not apply to any large lots, nor to iron to be delivered hereafter. For round orders the producers are asking a considerable advance, the tendency being in the direction of a conservative business rather than in favor of the reckless selling that prevailed some months ago. A great deal of manufactured iron is finding a market at this season, and at slightly better prices. The makers of agricultural implements as well as bridge builders and the producers of structural iron, report a very good business, which, in a short time, ought to tell on the raw material. The demand for bar iron is more than good, and sheets are showing signs of improvement. Combination iron holds its price, and metals, generally speaking, are firm.

LATER.—At the hour of going to press it is reported that the striking ore handlers at the Cleveland docks have agreed to return to work at the rate of eleven cents per ton—a reduction of fifteen per cent.—and that the strikers at Ashtabula are willing to submit their differences to arbitration.

THE IMPERATORI STEEL-MAKING PROCESS.

One of the most interest papers read at the recent Cleveland meeting of the American Institute of Mining Engineers, was one by Mr. J. B. Nau, of New York City, on "Experiments with the Imperatori Process at Croton Magnetic Mine, New York." The Imperatori process is a sort of mixed process in which a large amount of rich ore can be treated in the presence of a metallic bath. It is well known that the ordinary practice in the Siemens-Martin process consists in smelting in an open-hearth furnace a certain amount of pig iron together with a larger or smaller proportion of scrap, the amount of pig iron ranging from 10 per cent. upwards. The idea of substituting for a part of this sometimes very expensive scrap a corresponding quantity of rich iron ore led to the discovery of the Imperatori process, the effect of adding the iron ore being to energetically oxidize the silicon, carbon and manganese of the pig iron. In brief, the new process consists substantially in treating an intimate mixture of finely pulverized rich iron ore (at least 50 per cent. of iron) and carbonaceous materials, agglomerated into briquettes, in the presence of a metallic bath of pig iron or carbureted iron. The briquettes in question consist of coal, coke and lime, mixed in varying proportions, or they may contain anthracite or charcoal.

Very elaborate tests of the new process were made at the Croton magnetic mine in New York, last April, the particulars of which are given in detail by the writer. The commercial results are shown in the following comparative tables, the first showing the cost by the Siemens-Martin process, and the second the Imperatori:

ORDINARY PIG-AND SCRAP PROCESS.

One ton of iron charged {	Pig iron, 0.30 @ $19	$ 5.70
	Scrap, 0.70 @ 21	14.70
Loss 10 per cent.; hence, cost of 0.9 ton product		$20.40
" 1 " "		22.67

IMPERATORI PROCESS.

0.40 ton pig iron, at $19	$ 7.60
0.20 scrap, at $21	4.20
0.26 iron in 40 per cent. ore, at $7.41	2.96
0.86 ton iron charged	$14.75
Hence, 1 ton of iron charged (or, after allowing for 10 per cent. loss, 0.9 ton product), would cost	17.16
Or, cost of 1 ton of product	19.06
To which must be added 4 per cent. excess of gas coal over the 30 per cent. of the weight of the steel which is required in the ordinary process, or 0.04 ton, at $3	0.12
Making a total, for material and fuel, of	$19.18.

The difference in favor of the Imperatori process is $3.49 per net ton of steel obtained. This economy is important, but it does not constitute the only advantage of the process. In an average charge in the Imperatori process, composed, as has been said, of 40 pig, 20 scrap and 40 ore, the chemical composition of each constituent can be accurately ascertained. The pig iron will generally be low in silicon, sulphur and phosphorus; at the same time such iron can easily be obtained at reasonable price. The scrap used can be wholly supplied by the crop-ends, rail-ends, etc., from the works themselves, no outside scrap need be provided; consequently its chemical composition will be the same as that of the finished product, and can always be relied upon.

Another very advantageous feature of the Imperatori process is the facility with which many ores, hitherto almost useless, could be treated, thus enlarging their market, now very limited. Thus, many lean ores largely found in the States of New York and New Jersey, and, in fact, in almost every one of the United States, once ground and concentrated, would constitute an excellent material for this process.

In Morris country, New Jersey, ores are mined containing only from 30 to 37 per cent. iron, with 0.085 sulphur, and 0.06 phosphorus, which, concentrated, furnish powdered ore containing 64 to 65 iron, 0.02 sulphur, and 0.02 to 0.03, or even less phosphorus. These are well adapted to be used in the Imperatori process.

Besides these concentrates, most of the magnetic sands found in large deposits in Canada and in the United States, and containing a high percentage of iron (as high as 66 per cent. in certain cases), could be made available by this process. Many of these sands, if not rich, are physically associated with earthy substances which a simple washing could remove, furnishing a practically almost pure oxide of iron in powder, at a low price and particularly well adapted to be made up into briquettes.

Another advantage of this process is its easy adaptation to any existing open-hearth plant, or it can be carried on in any existing furnace without the slightest alternation or addition.

WONDERS OF ELECTRIC WELDING.

Electric welding machines are now used for a wide range of work. They have been successfully applied to the following purposes:—

Uniting Norway iron to Swedish steel, in such shapes as are required in carriage irons and fifth wheels.

Welding the crescent tires of bicycles, and afterwards forming the same by dies at the same heat.

Making a weld in a wire rope to avoid the tedious, and, in some cases, impossible operation of splicing.

Manufacturing spinning rings, displacing the old method of stamping the ring from a sheet of metal, and, after finishing it in a lathe, case-hardening the whole. By the new method these rings, about 2½ inches in diameter, are formed from an ordinary piece of bar iron.

Welding large car ties.

Joining long lengths of rails together, probably the heaviest work done at present in electric welding

Uniting wrought iron spokes to cast iron hubs, and after upsetting the same, welding them into the tire.

Welding brass to steel, in type-bars.

Welding the hard steel in band saws, and, more wonderful still, replacing the broken teeth in steel saws by welding in new ones. Formerly the damaged saw had to be cut down to one of smaller size.

Manufacturing long, continuous coils of pipe for ice machines, blast furnace tuyeres, and radiators.

Welding ship chains up to two inches diameter links.

Making conical shell and shrapnel for smaller armor-piercing guns.

As remarked to the writer by the manager of the company engaged in the development of this marvelous machine, "We are making history." The results already achieved amply justify the remark.

ENGLISH IRON AND STEEL EXPORTS TO THE UNITED STATES.

Great Britain's exports of iron and steel to the United States during April and the four months of 1891, compared with last year, were as follows:

	To U. S.			
	April		Four Months.	
	1891.	1890.	1891.	1890.
Pig	2,954	10,303	12,341	32,564
Bar	196	403	1,230	1,545
Railroad	1,251	34	3,679	1,849
Wire	355	838	1,107	1,638
Hoops and sheets	512	1,030	1,328	3,490
Tinplates	45,208	23,373	144,117	82,615
Cast and wrought	211	341	756	1,155
Old iron	905	2,853	5,774	7,609
Unwrought steel	716	2,002	5,991	6,111
Totals	52,308	41,177	176,323	138,576

The most noteworthy thing in the above table is the great increase in tinplate exports, the gain in April over March being 95 per cent., and in the four months 75 per cent. Of course, this is to be accounted for by the fact that the new McKinley tariff will soon go into operation; hence, the rush.

THE BEAUTIES OF THE PIG IRON WARRANT SYSTEM.

Recent files of the English iron trade papers go to show still more clearly how completely the pig iron market in that country has drifted into the hands of the London speculators, thanks to the storage warrant system. Says the *Iron and Steel Trades Journal*:

The continued advance in Scotch warrants does not suggest that any decided improvement has occurred in the general condition of the iron and steel trades. It is but too evident that the market has been cornered, that the "bears" have oversold, and that before they can get out, the London speculators, who are already said to have netted £250,000, will increase the amount of their "unearned increment." Both at Glasgow and Middlesbrough the stocks in the stores are increasing, as the smelters find that the best market for their iron is the stores, and by exchanging their metal for warrants they obtain for it several shillings per ton more than consumers or shippers will pay. When the "bears" have been thoroughly squeezed, we must expect to see the market away down again below 50s.

Confirming the above view, the *Iron and Coal Trades Review* says:

The Glasgow warrant market is still under the control of the bull syndicate, and while this is the case, legitimate business must suffer. There has been a constant up and down movement in warrants this week. The closing quotation yesterday (Thursday) was 55s. 9d. cash with buyers, sellers asking 3d. more. There is no large demand for Scotch makers' iron, unless for such special brands as are scarce. In the North of England pig iron trade not much of legitimate business has been done this week, the unsettled condition of the warrant market causing both buyers and sellers to be reserved. At the same time, Cleveland makers are rather profiting by the high price of Scotch iron, and are selling largely to Scotland. Thus, whatever damage the continued forcing up of prices of Scotch warrants may do to trade in general, it is telling in favor of the business of the Cleveland ironmasters.

Even the conservative *Colliery Guardian* is moved to remark:

The return of what appears to be a touch of reckless speculation in the

Glasgow warrant market, the position of one of the leading Cleveland steel firms, and the issue of the average selling prices in the northern and midland iron trades, respectively, are circumstances which, coming concurrently, may well stimulate reflection upon the position of the British metal and mineral trades and their prospects for the Summer trade upon which we may now be said to have entered. It cannot be considered that the Spring so far has fulfilled the anticipations that some months ago were indulged respecting it. No sooner had trade begun to recover from the effects of the disturbance caused by speculative movements in Scotch warrants than financial complications assailed it. Add to these two circumstances the fact that several of our cheap foreign markets have been from various causes, both political and pecuniary, crippled in their purchasing capacities, and we have ample grounds for the weakness which the British iron and steel trades have now for some time manifested.

Dullness in Scotland has now been succeeded by short periods of feverish inflation, and the manipulations of "bulls" and "bears" have quite unhinged the market. An unsettling influence has thus been communicated to the north of England, nor is it reassuring to find, from the return just issued from that district, that the average selling price has further declined. At the same time, it cannot but be that some relief in the cost of production will be afforded to ironmasters in the two chief iron districts of the kingdom by the reductions which have been decided upon, both in Cleveland and in Staffordshire. There is no doubt that prices are low just now in the steel trade. Some buyers, indeed, report being able to purchase steel ship plates at £6, and steel angles at £6 15s., both less 2½ per cent. for cash, whilst heavy steel rails are in some cases said to be obtainable at as low as £4 10s.

"Reckless speculation," "dullness succeeded by short periods of feverish inflation," cornering and overselling are the legitimate fruits of the warrant system; and it is not to be wondered at that the solid, conservative sentiment among American iron makers is decidedly adverse to the growth of the system in this country.

CONCERNING CANADA'S DESTINY.

Mr. Corden prophesied that the adoption of free trade by England would undoubtedly be followed by the general acceptance of the principle by all nations within ten years; but after 38 years of British free trade, Mr. John Bright admitted that through it "the agricultural classes of Britain had lost more than 150,000,000 pounds sterling." Truly, under her non-protective system Britain is losing her supremacy in manufactures, trade and navigation; and she is no longer queen of the realms of commerce, mistress of the seas, or creditor in chief of the human race. Her free trade policy has done it.—[Canadian Manufacturer.

Well, well, if that is "treason," make the most of it. That it is a fact, there can be no doubt. But to have the fact stated so frankly, so clearly and so emphatically, and that by a leading Canadian journal, an able advocate of the National Protective policy of that country, and a vigorous supporter of the present Tory Government, is refreshing, to say the least. Beyond question Great Britain has lost immensely through free trade and not the least among her losses may be that of a prosperous, intelligent and liberal-minded people at the North of us. That Canada will ever become an integral part of the United States we very much doubt Indeed, we fail to see the desirability on either side of such a union. But we do sometime look for a complete separation from the mother country, politically as well as commercially; and no surer way of bringing about this result can be had than that of building up on this continent a people whose prosperity comes from a policy totally at variance with that of Great Britain.—[Iron Trade Review.

These kind words are appreciated. Our Cleveland contemporary comprehends the situation. Canada will always entertain the kindliest feelings toward Great Britain. There will probably be a political separation some day, but it will not be through revolution such as made the United States a nation Canada desires to live in peace and amity with the United States, but all aims at annexing her must be abandoned. She has a different destiny before her. —[Canadian Manufacturer.

Objections to the Ship Canal.

The Iron Trade Review is desirous of knowing why this journal opposes the Pittsburgh and Lake Erie ship-canal scheme while speaking favorably of the plans for a canal or ship railway from Owen Sound to Lake Ontario. The answer is simple and is in accordance with the most forcible arguments that has been presented on the lakes against the Pittsburgh scheme. Who would not admit that the construction of a canal like the Welland between Owen Sound and Lake Ontario would be the means of building up a very large commerce, through the saving of distance around the St. Clair and Detroit rivers to the Welland before Lake Ontario is reached, as at present? Such a waterway would be suited to the class of craft now engaged in Welland canal traffic and would greatly shorted the water haul to the sea-board. On the other hand what use could be made of a water-way of Welland canal size between Lake Erie and Pittsburgh, where traffic is in coal and ore, for which the general government has wisely laid down a policy of providing a channel 20 feet deep between Duluth, Chicago and Buffalo. To provide business for this Pittsburgh canal, Mr. J. M. Goodwin, of Sharpsville, Pa., would have the ship owners of of the lakes discard an experience of almost a century that has brought them to the ownership of the finest freight steamers in the world and return to the tow barges, now almost extinct in the ore and coal trade, or the canal schooner the history of which in the same trade will soon be forgotten. Mr. Goodwin's entire report is based on this inferior class of craft, although one of the modern ore carriers will deliver in a season as much as fifteen canal schooners.—[Marine Review.

THE FIRST IRON BLAST-FURNACES IN AMERICA—I.

BY W. H. ADAMS, M. E., NEW YORK CITY.*

Shortly after becoming one of the van-guard of mine-developers in the State of Virginia, during the year 1883, I called the attention of the Institute to certain deposits of pyrites, which have been largely worked since.

In all cases these deposits are covered with iron ore (limonite), extending 40, 50 or 60 feet from surface to water-level.

The several classes of brown iron ores are found almost continuously along a prominent ridge of mineral-bearing slates, which can be traced from the James river northeasterly to the North Anna, the Rappahannock and the Potomac rivers, crossing the counties of Louisa, Spottsylvania and Stafford. Outcrops are plainly discoverable from end to end of this belt, also in places to the right and left of it, and at intervals there are evidences of workings, some of them for known purposes and others of unknown age and meaning.

These old workings have an interest aside from the minerals they may contain or may have yielded. I have been engaged during the past five years in the collection of facts concerning them, which might determine definitely the site of those iron furnaces, placed by tradition within reach of "the towne called Germanna," which were the first ever built in this State or in this continent.

The events which led to the establishment of this important industry are sufficiently narrated in a paper written by Mr. R. A. Brock, Secretary of the Virginia Historical Society, and printed in the *Proceedings of the National Museum*, 1885, page 77, from which I quote the following:

"To Virginia, the first of the English settlements in America, belongs the honor of inaugurating within her limits, as a colony, that most important industry, the iron manufacture.

"The London company contemplated a variety of enterprises from the very beginning of its authority; prominent among them was that of iron manufacture. In 1610, Sir Thomas Gates testified before the council of the company at London, that in Virginia there were divers minerals, especially 'iron-oare,' lying upon the surface of the ground, some of which, having been sent home, had been found to yield 'as good iron as any found in Europe.'

"Under a new administration of its affairs, the London company in 1619, after 12 years of unprofitable expenditures, sent to Virginia a large body of emigrants, including workmen, and materials for some new branches of industry. These embraced no less than 100 persons skilled in the manufacture of iron, who were sent out with the design of erecting in the colony three iron works.

"Of these, 110 were from Warwickshire and Stafford, and 40 from Sussex, all selected for their skill and industry. A part of the funds liberally contributed in England about this period, for a college at Henrico, to educate the native and colonial youth, was appropriated by the treasurer, Sir Edwin Sandys, to the erection of iron works, in the expectation of deriving a revenue from that source. Works for smelting the ores were erected in 1619 on Falling Creek, a tributary of James river, in Chesterfield county, about seven miles below the present city of Manchester, and the most sanguine hopes of profits were cherished.

"Three of the master-workmen having died, a reinforcement of 20 experienced hands was sent over in 1621, accompanied by Mr. John Berkley and his son, Maurice, as skilled persons to superintend the operations. A mine of brown iron ore was found in the neighborhood and opened, yielding a 'reasonably good iron.'

"But the jealousy of the natives had unfortunately been aroused. In an hour of fancied security, when all suspicions of hostilities had been lulled by the friendly protestations of the Indians, on the morning of Friday, March 22, 1622, a general attack was made by the savages upon the settlements of the colony, and 347 persons were slain. Of those engaged at the iron works at Falling Creek, all perished save a boy and girl, who fled to the bushes for safety.

"The iron works being demolished, so great was the discouragement that a long time elapsed before the useful manufacture was again attempted in Virginia. A writer from the colony, in 1649, published that an 'iron work erected would be as good as a silver mine.' The exportation of iron from the colony was forbidden by an Act of the Assembly in 1662, on penalty of 10 pounds of tobacco for every pound of iron exported; and this prohibition was renewed in 1682.

"Colonel William Byrd, the first of the name and family in Virginia, obtained April 20, 1687, a grant of 1,800 acres of land in Henrico county, on the south side of the James river, which included the site of the ill-fated iron works on Falling Creek.

"October 20, 1696, he also obtained a patent for 5,644 acres lying contiguous thereto, giving as a reason for such action that 'there had been iron works on Falling Creek in the time of the company, and Colonel Byrd having an intention to carry them on, and foreseeing that an abundance of wood might be necessary to so great a work, he took up a large tract,' etc.

"He died on the 4th day of December, 1704, and it is not known that either he or his son and heir, of the same name and title, ever instituted any further steps toward the revival of the works on Falling Creek."

It will be understood that the iron works noted above employed the modified "Catalan forge," types of which are yet to be found in this country.†

This much of the earlier history of iron-making in Virginia makes us wish that sufficient records had been preserved to enable us to construct a consecutive narrative of all the operations of the colonists. It is certainly reasonable to suppose that the explorations, made by the several parties brought out from England at different times, must have extended over a wide area, and must also have resulted in discoveries of value.

*Cleveland Meeting, January, 1891.

†Dr. T. Sterry Hunt objects to the term "Catalan forge," insisting that we have in this country only types or modifications of the old "bloomery process," brought from Germany.

In June, 1870, after excessive rains, the long dam on the Jones branch of the Chickahominy river, in New Kent county, was broken, with much damage to the mill and surroundings. The force of the current washed out and disclosed the remains of an early forge or bloomery, including some of the foundation timbers, bricks from a chimney, an anvil, a hammer and six bars of cast-iron, all of which can now be seen near by. The cast-iron bars and hammer bear no date, but have the letters "Deep Creek" cast on their surface. No record of such a location or furnace can be found, although "Deep Creek" might have been the home brand of some furnace in the old world. The location where the washout disclosed these relics is now known as Providence Forge. Tradition credits the erection of this forge to Colonel William Byrd; but no date is given, although discoveries of more than passing value must have been made to induce him to renew the realty-ownership of the Falling Creek property in the year 1696, as noted above.

After a long period of silence as to the actual doings of the colonists who were brought over for the special purpose of iron-making, history takes up the thread again in the year 1714, at which time there was an importation of Germans, whose destination and *status* has been the subject of a great deal of discussion, owing to the fact that, as they were recruited by Baron de Graffenreidt, and have been spoken of as Palatines, some persons have supposed them to belong to the first colony of Palatines, brought over by him, which founded, under a patent of 1709, the town in North Carolina called New Berne, after Berne, in Switzerland. A considerable number of these colonists were massacred by the Tuscaroras in 1711. But it can be proved beyond question that another German colony landed at Rappahannock, in 1714, coming direct from Oldenburg, Germany; and, gathering all the data lately brought to light with regard to the doings of these people, we find that they were at once taken to the territory within 30 miles of the present town of Fredericksburg, where extensive explorations must have been made to justify the large expenditure thus incurred. What it meant to locate a colony so far from any base of supplies will be appreciated by those who have perused the earlier history of the struggles and privations of the colonists on the James river.

We know that somewhere in the region between the falls of the Rappahannock river and the site of Germanna, there had been established, as early as 1676, a fort or outpost for protection against Indian incursions; and it is reasonable to suppose that some settlements were made between that fort and the river at Fredericksburg. Spotswood became Governor in 1710, and shortly after accomplished the memorable passage of the Blue Ridge, previously deemed impassable for the whites. No doubt, he learned during this trip, as his route was by way of the Rapidan river, the character of the country about Germanna, its ores, soils, climate, roads, etc, and it is also supposable that among those who accompanied him on his march to the "vast mountains," there were iron-masters from the James river settlements. The experience of these iron-masters with the shallow deposits along the lower river, and the poorer classes of silicious ores about the upper river, at Lynchburgh, etc., must have inclined them favorably at once towards the section through which they traveled, as they crossed belt after belt of country showing signs of iron everywhere, and noted along the Rapidan the excellent deposits of drift iron ore. These latter exist to-day, the deposit at the South crossing of Germanna being of notably good quality.

What more natural than the drifting of a mining community towards the territory, which, upon superficial examination, or, perhaps, after working tests by small parties, appeared to be supplied with ores so clean and tractable that old forge-processes were not thought of, and direct smelting for pig iron was determined upon from the start?

Governor Spotswood enters into the historical record at this point in a communication, under the date of 1714, to "Ye Lords Commissioners of Trade:"*

"An act for exempting German Protestants from the payment of levies is made in favor of several families of that nation, who, upon the encouragement of the Baron de Graffenreidt, came over hither in hopes of finding out mines. They were engaged principally in mining in their native land, but the Baron's misfortunes obliged him to leave the country before their arrival. They have been settled upon the frontiers of the Rappahannock, subsisting chiefly at my charge and on the contribution of some gentlemen that have a prospect of being reimbursed by their labors."

There is a conflict of authority as to the numerical strength of this colony, but the Rev. Philip Slaughter, D. D., one of the most patient investigators of Virginia history, cites† a memorial from the archives of the "English Society for the Propagation of the Gospel in Foreign Parts," which places the number of emigrants at 32 families, and gives the name of the minister who served them as Henry Haeger, a man about 75 years old.

Hugh Jones, in his *Present State of Virginia*, published in London in 1724, says:

"Beyond Colonel Spotswood's furnace, above the falls of the Rappahannock river, and within view of the vast mountains, he has founded a town called Germanna, from some Germans sent over by Queen Anne.....Beyond this is seated the colony of Germans or Palatines, with allowance of a good quantity of rich land who thrive very well and live happily and entertain generously."

There is a tradition that some of the Germans were massacred by the Indians during the first year; but this is evidently an error, growing out of the earlier troubles. There is no proof that the work was halted from any cause, but on the other hand, there are evidences of the prosperity of the colony in the records of little difficulties engendered over land sales, such as incidentally exclude the hypothesis of more serious embarrassments. In 1716 Spotswood was charged with transferring land in that section to his personal favorites, instead of to the Germans, as directed by the Crown. In answer to these accusations, he said: "The Germans were not insensible to the kindness he had shown them, and that, instead of their being his tenants, they might have been his servants, in view of the passage money, 150 francs, they owed him." The books of the Register of the Land Office show that in 1722, Spotswood granted to Richard Hickman 28,000 acres of land, for a monetary consideration alone. In 1732, the same land was "confirmed" to Spotswood, the consideration expressed being a nominal sum of money and the importation into the country of certain Germans, whose names were given.

Colonel Byrd (second of the name and title), in his *Progress to the Mines*, thus speaks of Germanna:

"This famous towne consists of Colonel Spotswood's enchanted castle on one side of the street, and a baker's dozen of ruinous tenements on the other, where so many German families had dwelt for several years, but they are now moved higher up the river on land of their own. I let him understand that besides the pleasure of paying him a visit, I had come to be instructed by so great a master in the mystery of making iron, wherein he had led the way, and was the Tubal Cain of Virginia. He corrected me a little there by assuring me he was not only the first in this country, but the first in North America who had erected a regular iron furnace. That they ran altogether on bloomerys in New England and Pennsylvania, till his example had made them attempt greater works. But in this last colony, they have so few ships to carry their iron to Great Britain, that they must be content to make it for their own use, and must be obliged to manufacture it when they have done. That he hoped he had done the country a very good service, by setting so good an example. That the four furnaces now at work in Virginia, circulated a great sum of money for provisions and all necessaries.....that they are besides a considerable advantage to Great Britain, because it lessens the quantity of bar iron imported from Spain, Holland, Sweden, Denmark and Muscovy, which used to be no less than 20,000 tuns yearly, though at the same time no sow iron is imported thither from any country, but only from the plantations. Then I enquired after his own mines, and I hoped as he was the first to engage in this great undertaking, that he had brought them to the most perfection. He told me he had iron in several parts of his great tract of land, but that the mine he was at work upon was 13 miles below Germanna. That his oar, which was very rich, he raised a mile from his furnaces, and was obliged to cart the iron when 'twas made, 15 miles to Massaponax, a plantation he had upon the Rappahannock river.....He had been building an air furnace at Massaponax, which he had now brought to perfection, and should be thereby able to furnish the whole country with all sorts of cast-iron, as cheap and as good as ever came from England. Colonel Spotswood said a furnace could be built for £700, if I went the nearest way to do it, especially as coming after so many, I might correct their errors and avoid their miscarriages. That freight, customs, and other charges in England, amount to 27s. a tun.....The whole expense here, and in England, may be computed modestly a £3 a tun—the balance, say £3 a tun profit. We drove over a fine road to the mines, 13 measured miles from Germanna, each mile marked distinctly on the trees—all the land hereabouts seems paved with iron ore, so that there seems enough to feed a furnace for many ages. From hence we proceeded to the furnace, which is built of rough stone, having been the first of that kind erected in the country. Here the wheel that carried the bellows was no more than 20 feet diameter; but was an overshot wheel that went with little water. This was necessary here, because water was sometimes scarce, notwithstanding 'twas supplied by two streams, one of which is conveyed 1,900 feet through wooden pipes, and the other 60. The name of the founder employed at present is one Godfrey, of the Kingdom of Ireland, whose wages are 2s. 6d. per tun for all the iron he runs, and his provisions. This man told me that the best wood for coaling is red-oak. He complained that the Colonel starves his works out of whimsicalness and frugality, endeavoring to do everything with his own people, and at the same time taking them off upon every vagary that comes into his head."

This evidence proves that between 1714 and 1739, the year of Governor Spotswood's death, active work was going on in what was then known as Spottsylvania county.*

No records have been found, as yet, giving the details of the work of this colony of miners and furnace workers, the extension of operations from time to time, the amount of ore mined, or of pig iron made and sold, etc.—details which would have thrown much welcome light upon the establishment of the iron industry on this continent.

I have endeavored, as a labor of love, to make good this defficiency of documents as far as possible, by tracing the old mines along the outcrops from end to end, thus adding, step by step, to the meagre records such facts as make clear the reasons for operations in this particular direction, and also account, in a measure, for the absence of other data on this subject of really national importance.

A map of the country covered by these investigations shows the deposits of iron ores opened by the German Palatines and their successors to extend to a point north of the Rappahannock river, southwest to the present crossing of the Cheaapeake & Ohio Railway, at Mineral City. The wagon roads traced on the early maps have been of the greatest assistance to me. Many of them, though now obliterated, overgrown and fenced off, have been found, nevertheless, by careful search. Following these roads, and within easy reach of them, the openings or iron pits occur mainly along the belt of the brown ores—the variety most extensively mined, the specular ore of the Western belt being more difficult to mine and transport. The openings are never deeper than 30 feet, but they range from a few feet to 1,200 feet in length.

Following this mineral belt by means of the roads laid out by Governor Spotswood, it is proper that we start from the town made memorable by him as the center of radiating industries and flourishing communities, for the early prosperity of which he deserves more credit than the present generation remembers to be his due.

[Continued next week.]

* Spotswood Letters, Vol. I., page 20.

† History of St. George's Parish, page 98.

* Orange county was divided from Spottsylvania county in 1734.

AMONG THE IRON MINES.

Lake Superior Mining Notes:—

GOGEBIC RANGE.

The shaft house at No. 4 at the Anvil was burned down last Saturday night, and the fire continued to work its way down the shaft timbers all the next day before it could be extinguished. As this was the principal shaft being operated at present the loss is quite severely felt all around, in the practical closing down of the mine until it can be rebuilt. The work of repairing the shaft has been going on during the week, and the foundation for the new shaft house was begun yesterday.—[Pick and Axe, June 6.

A new shaft house has been put down on the west portion of the Pence. At a depth of 425 feet, a fine quality of ore has been found, running over 68 per cent. in iron, and a drift is now being run east and west through this excellent ore. Within the past four weeks a fine new shaft house has been put up, in which a skip has just started. Fifty men are employed, all that can be used at present. This shaft is 1,100 feet from the Hennepin, and close to the Snider line, on which property the same vein is expected to exist.—[Montreal River Miner.

MARQUETTE RANGE.

There should be a reduction of about 50 per cent. in amount of mine royalty as now observed. The condition of the market, high rate of rail-freight, demands it. It would be a greater incentive to the work of exploration and would be of benefit to land owners on that account. A sliding scale of royalty, presented by several of the land concerns in this section, is a fair one.—[Iron Ore, Ishpeming.

At the hematite mine of the Lake Superior Iron Co., four gangs of men have been employed in the new workings at the east end of the property this week, a transfer having been made from the old mine hematite pending the repairing of a skip road. The new mine is looking well, showing large bodies of high-grade ore. The only fault found is that the price is much too low for so fine a product. It is really too bad that such ore has to go for so low a price. There is not much of it in the country, and unless the supply increases at some of the new fields, the day will soon come when Bessemers will be in demand at high figures.—[Iron Ore, Ishpeming.

MENOMINEE RANGE.

No. 1 shaft at the Hemlock is down 100 feet, and a second (No. 2) shaft is going down at a satisfactory rate. The new shaft house will be completed about August 1, when hoisting from the new shaft will begin. The Hemlock is opened up for a distance of 1,000 feet, with an average width of 40 feet. The ore is of a very high grade, and what is particularly remarkable concerning this wonderful mine, considerable ore has been found in spots which assays 95 per cent. in metallic iron. The Hemlock is sending an average of 120 tons per day to a Milwaukee furnace, but will commence shipping a much larger quantity to Escanaba when shaft No. 2 is ready for business. The Hemlock will eventually become the greatest ore producer on that part of the range, and the quality of the product is only equal by one other mine—the Mansfield.—[Florence Mining News.

One at the owners of the Miller exploration, near Iron river, reports the opening up of a 60-foot vein of good ore upon the property. The working shaft is down about 175 feet, and if there is any kind of improvement in the iron market this Summer, the Miller will undoubtedly cut quite a figure in shipping circles.—[Florence Mining News.

Flattering developments are being made at the Hope, section 27, 43-32, and the property is in every way highly satisfactory to the new owners. The shaft is now down 175 feet, from which two levels are being wrought. At the bottom a crosscut is going in south of east and shows well. Average analysis of the ore gives about 64 per cent. metallic iron. The Chicago & Northwestern has a spur track surveyed to the mine and the iron can be had at any time. —[Florence Mining News.

VERMILION AND MESABA RANGES.

Nearly 30 miles almost directly west from Mesaba station on the Duluth & Iron Range Railway, is located the mining camp of the Mountain Range Iron Co. in section 34, 59-18, on what is known as the Lemere claim, being the south four "forties" of the section. Work was commenced here during the latter part of August, 1890, under the superintendance of Capt. Nicolls, an old, experienced mining man. At first developments were confined to the Lemere claim, and several very encouraging testpits opened up, assays of the ore running up in the sixties. Shortly after, explorations were begun on the northwest of the northwest of 3, 58-18, a part of the Josh Helmer claim. This has since proven to be one of the very best iron properties now in the course of development, and it is believed by many to contain one of the largest deposits of ore in the Minnesota districts. Eight test-pit shafts varying in depth from 40 to 60 feet, have been sunk something in the shape of a horseshoe, with an additional shaft in the center. In shaft No. 1 the ore was struck at a depth of 24 feet and continued 26 feet. At this point drifts were driven—one north 33 feet and the other south 16 feet, both continuing in good red hematite ore, an assay of which resulted as follows:

Iron	67.946
Phosphorus	.030
Silica	2.61

Shaft No. 2 is down 62 feet, 46 feet of which is through ore. This shaft and No. 1 are the only two which are through the vein and are bottomed in a quartzite foot wall. Shaft No. 3 is one of the best looking on the property and has passed through over 21 feet of ore, being still bottomed in a hematite very much resembling in general appearance the granular ore of the Chandler mine at Ely. An assay gives in iron 66.102, being, too, within the Bessemer limit. The center shaft is the deepest one on the Merritt property, and from the fact that it is still in iron ore has been the source of much satisfaction and confidence. It is a little over 60 feet deep, 52 feet of which is through ore. Of the remaining shafts, every one is bottomed in ore, and down through the vein a distance of from 44 to 35 feet. In addition to this test-pit work, three diamond drill holes have been driven with a Sullivan drill, and in every instance, have they given most satisfactory results. Other assays of ore from various shafts of this property have been made by the Illinois Steel Co. and at the Carnegie works in Pittsburgh, which have run from 59 360, the lowest, to 65 per cent. and even higher in metallic iron. The area included within the bounds of these test-pits is 122,500 square feet.—[Vermilion Iron Journals.

The Brwabik Iron Co. are carrying on extensive explorations by means of testpitting on what is known as the Colby claim in section 8, 58-18, about three miles west of the Merritt. The outlook is very encouraging.—[Vermilion Iron Journal.

Explorations are also soon to be commenced on the Brodie claim in section 6, 58 18, and the Buckley claim adjoining the Merritt mine on the west is also regarded as an excellent property, its owner, however, signifying no desire to sell.—[Vermilion Iron Journal.

Lake Superior Shipments of Iron Ore:—

Lake shipments of iron ore from the mines of Lake Superior, for the season of 1891, up to Wednesday, June 3, are as shown by the appended statement:

MARQUETTE RANGE.

Champion	2,062	Lake Superior	3,983
Total Marquette Range			6,045

MENOMINEE RANGE.

Ludington	20,414

GOGEBIC RANGE.

Aurora	6,567	Germania	1,768	Pabst	15,242
East Norrie	6,645	Mt. Hope	3,377	Palms	2,120
Father Hennepin	4,521	Norrie	24,143	West Cary	6,744
Total Gogebic Range					66,130

VERMILION RANGE.

Chandler	20,047	Minnesota	34,478
Total Vermilion Range			54,525
Grand totals			147,214

The Foreign Iron Trade.

The English iron market has been still further unsettled by the continued upward movement of warrants, the latter, in the Glasgow market, having gone up 3s. on the week, and Cleveland warrants 1s. per ton, while in hematite warrants an advance of 2s. 6d. has taken place. Partly owing to the holidays, and partly also on account of the rise, which is considered only temporary, very little genuine business has been done in pig iron, especially as sellers were asking from 1s. 6d. to 2s. per ton more than ruled at the end of last week. The disorganized state of the pig iron market has not improved trade either in finished iron or steel, and prices have still a rather downward tendency; but there is a more hopeful tone. Tinplates continue very quiet. Shipbuilders are booking a few more orders, but they are getting slacker from week to week, and the same conditions prevail in engineering, although in the latter department of trade there is still a fair amount of work in hand.

The strike of Belgian miners and iron workers—which, it should be remembered, was started for a political end, the granting of universal suffrage—still continues partially, but there are prospects now that work will be resumed generally at an early date. The effect of the strike upon the Belgian iron market has been most injurious. While there were consumers who would buy if they could obtain material, prices were and are still weak. The French iron market is not quite so strong as it has been recently, but prices are still tolerably firm. There is plenty of work to last some time yet. The German iron market has not changed much during the week. The coal markets of the Continent are all firm, but the tone varies greatly with circumstances. In Belgium the conditions of trade are still critical, owing to the strike. The strikes in Germany are practically all over, but they have greatly disorganized the industry. The French coal trade appears to have derived the greatest benefit from the suspension of work in the two countries, for it has led to an abundance of orders being placed in France.—[Iron and Coal Trades Review (London), May 22nd.

An Electric Power Hammer.

An electric power hammer has been devised which represents a radically new application of electro-magnetic principles. The novelty of the apparatus lies in the substitution of electro-magnetic power for steam, by a slight and very simple modification of the mechanism. The piston is of magnetic material, and the cylinder is composed of a series of coils, through each of which an electric current may be passed separately. The apparatus is virtually an immense electro-magnet, the cylinder being the coil, and the piston answering to the core. The passage of an electric current through the coils forming the upper part of the cylinder raises the piston into the magnetic field thus created. By cutting off the current and simultaneously transferring it to the lower coils of the cylinder, the piston is released, and its descent is accelerated by the magnetic attraction created below. As a magnetic field can be created in any of the series of coils, the blow may be shortened or lengthened as desired.—[Mining and Scientific Press.

The English Iron Markets.

Our English correspondents, S. W. Royce & Co., of Manchester, write under date of May 30: "This has been a very interesting month to those concerned in the metal trade. Pig iron has advanced steadily, the total increase at Glasgow being some 9s. per ton, and at Middlesbro' some 3s. per ton, warrants at Glasgow being now about 14s. per ton higher than at Middlesbro'. Shipments from Middlesbro' are heavy, but the advance in values arises mainly from speculative movements, and, in the present state of the markets, the sales to consumers are only of small dimensions."

THE WOODBURY AUTOMATIC HIGH-SPEED ENGINE.

The Woodbury high-speed steam engine is the invention of Daniel A. Woodbury, of Rochester, N. Y., one of the pioneers in the field of steam-engine building.

The engine has been before the public for about five years, and its introduction upon the market was preceded by a long-continued series of experiments, extending over a period of 18 months. It is now being manufactured by the Stearns Manufacturing Co., of Erie, Pa.

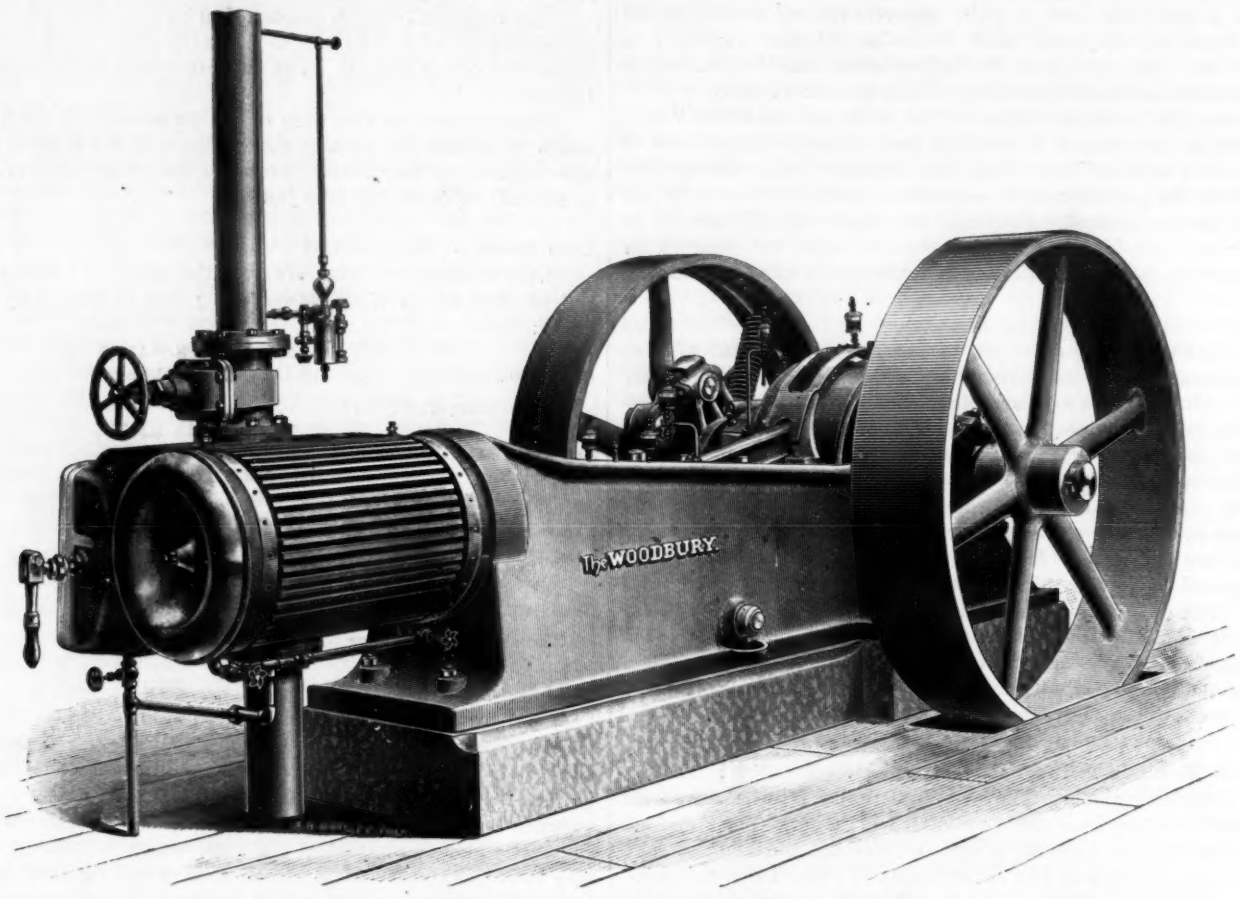

FIG. 1.—AUTOMATIC CUT-OFF HIGH SPEED STEAM ENGINE.

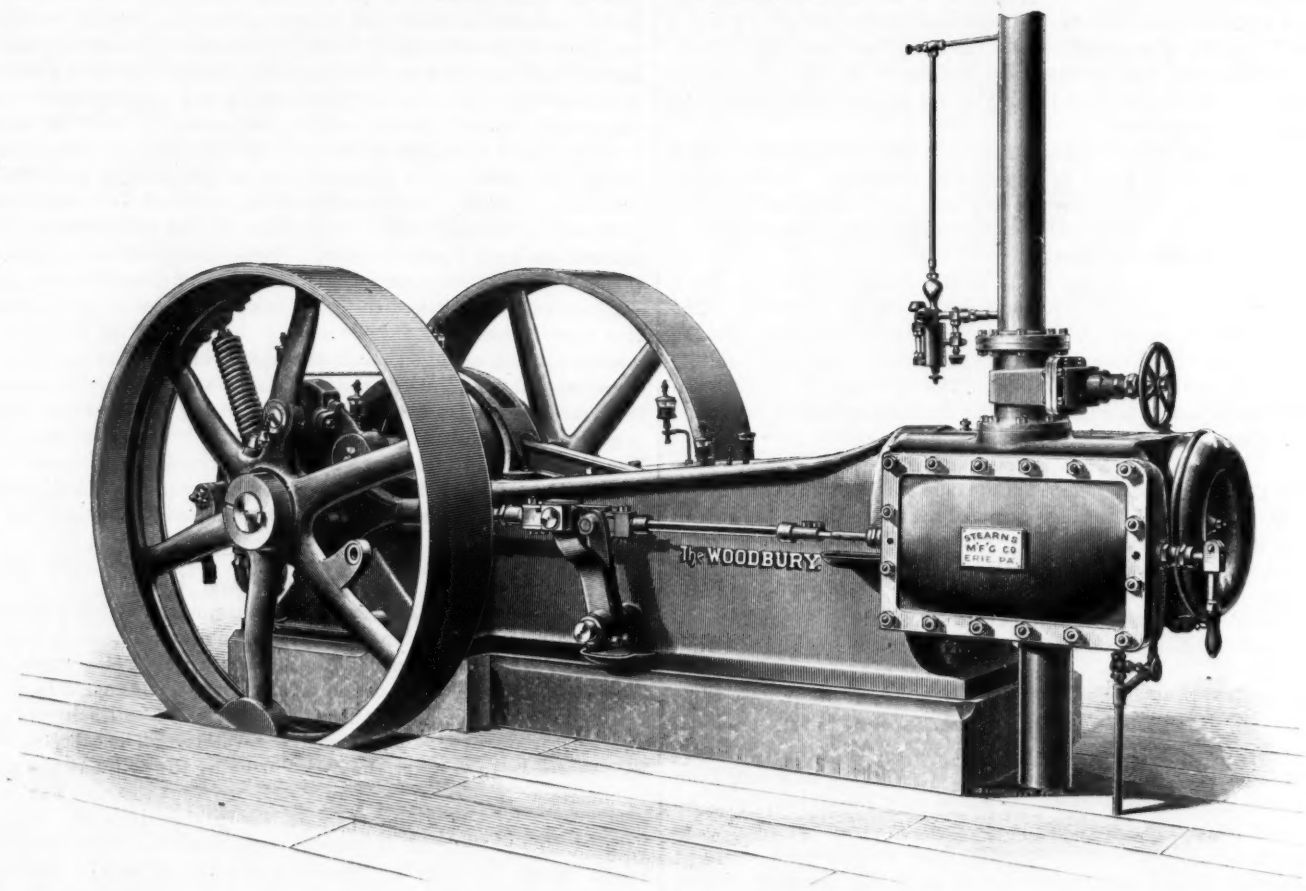

FIG. 2.—AUTOMATIC CUT-OFF HIGH-SPEED STEAM ENGINE.

The details of construction are in the following description presented more fully than is customary:

Referring to the cuts, Figs. 1 and 2 show the two sides of the engine. In the detail views; Fig. 3 is a horizontal section through the cylinder and valve; Fig. 4 a vertical section through the same; Fig. 5 a horizontal section through steam chest above top of valve; Fig. 6 a view of steam chest with cover removed, showing back of relief plate. In all the views like letters of reference indicate the same parts.

As will be seen by an inspection of the different views, especially Figs. 3 and 4, steam pressure is eliminated from the valve A by the relief plate B on the back, which is supported against steam pressure at top and bottom by a forked or double wedge, C, whose length is about equal to that of the relief plate. It is obvious that a longitudinal movement of the wedges inward will force the relief plate away from valve, and the outward movement of wedges will let it down toward valve. The movement of the wedges and the consequent adjustment of relief plate is accomplished by the two adjusting screws $l\ l'$, which fit loosely through cross piece of wedge and are tapped into relief plate. The collars of the adjusting screws are notched on their peripheries. The collar has 100 notches, and therefore admits of a definite degree of adjustment being made, the minimum limit of which is a very minute amount. On all sizes the adjusting screw is 10 threads per inch, and the taper of wedges 1 inch in ten. One notch on the collar, therefore, representing $\frac{1}{100}$ of a turn, moves the wedge lengthwise $\frac{1}{1000}$ inch, and the relief plate toward or from the valve $\frac{1}{10000}$ inch, corresponding to $\frac{1}{20000}$ inch on each face of the valve.

This device accomplishes the adjustment of the relief plate to the valve

[Continued on page 8]

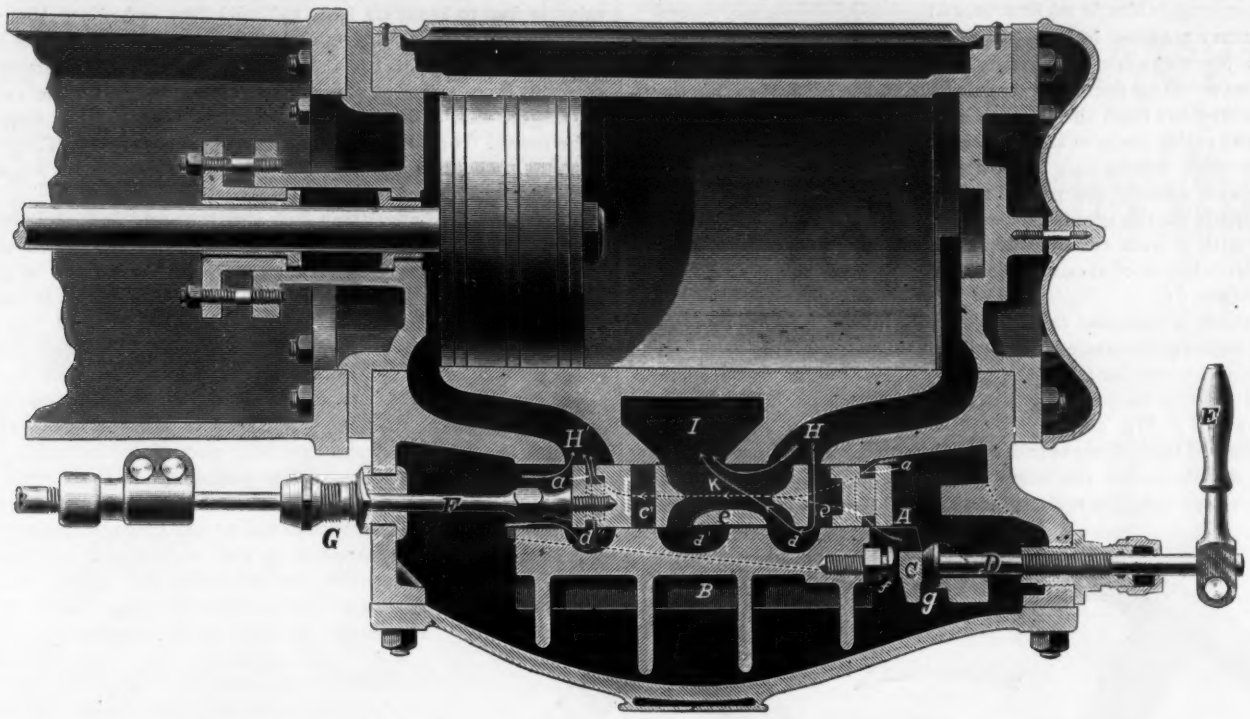

FIG 3.—HORIZONTAL SECTION THROUGH CYLINDER, STEAM CHEST AND VALVE.

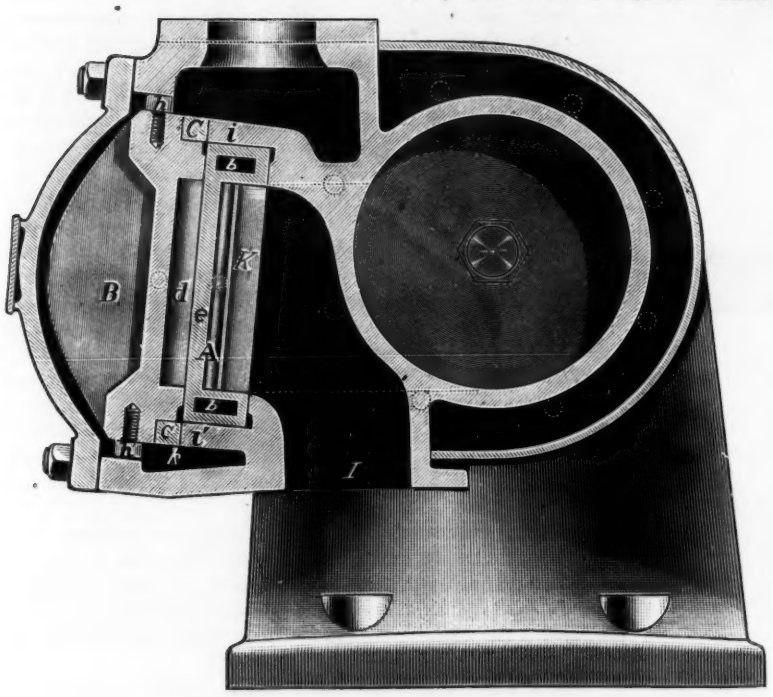

FIG. 4.—VERTICAL SECTION THROUGH CYLINDER AND VALVES.

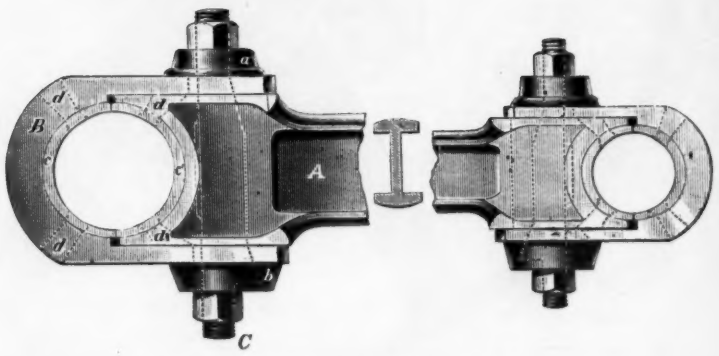

FIG. 9.—MAIN CONNECTING ROD.

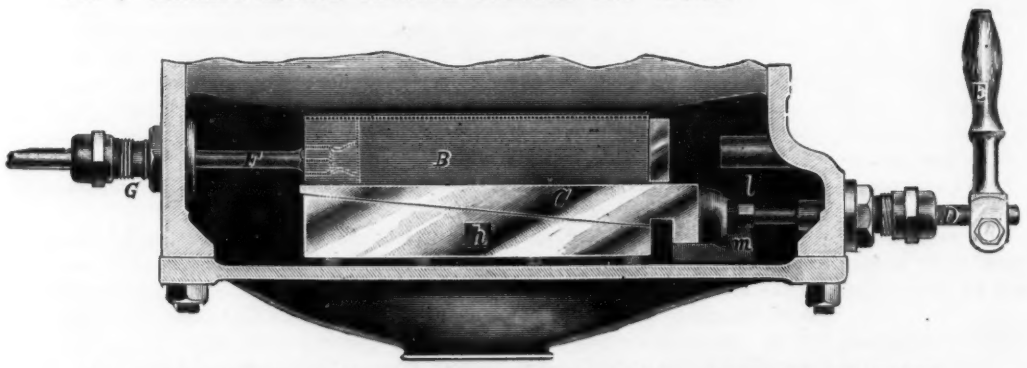

FIG. 5.—HORIZONTAL SECTION THROUGH STEAM CHEST, ABOVE TOP OF VALVE.

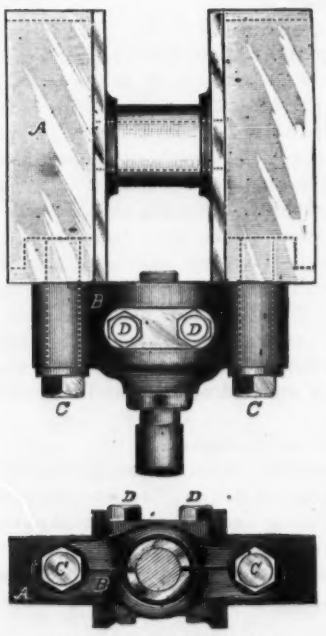

FIG. 8.—CROSS HEAD.

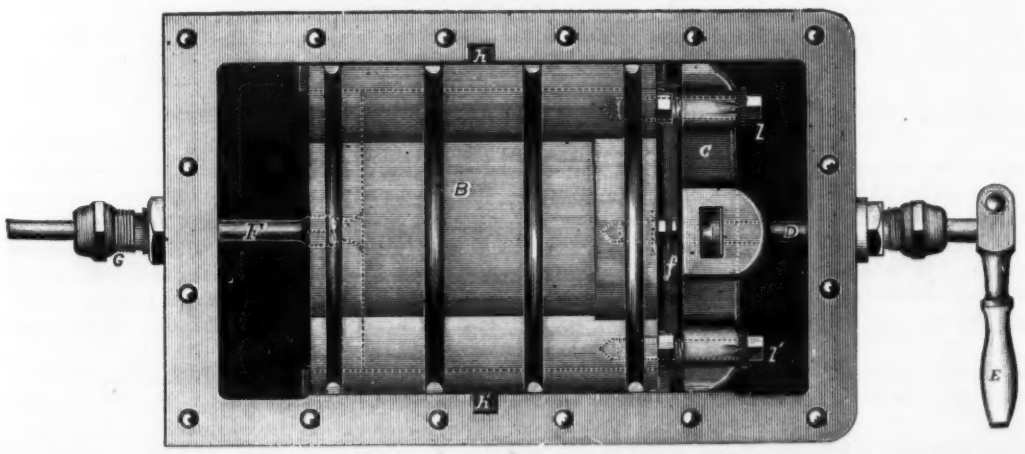

FIG. 6.—VIEW OF RELIEF PLATE AT BACK, WITH STEAM CHEST COVER REMOVED.

[Continued from page 6.]

in the most satisfactory manner, being at once positive and simple, and while the results of the adjustment can be extremely minute it is very quickly done and admits of the valve being perfectly steam tight and yet offering no more resistance to the movement than the friction of the stuffing box on the stem. The movement of the relief plate in the adjustment is exactly at right angles with the face, or, in other words, it is let down equally at all points, and this without guesswork and without any refitting after the engine leaves the works. The adjustment is made on the inside of the steam chest, and no meddlesome person can tamper with it from the outside. The passage *k* at the bottom of the chest allows a circulation of steam under the ledge, insuring equal temperatures for the ledges *i i'*.

The screw D, which is operated from the outside by the handle E, is also used as a means of moving the wedges inward and throwing off the relief plate for a purpose explained hereafter; but the plate cannot be let down further than the adjustment allows, as the wedges cannot be drawn back further than the collars *m* of screws *l l'*, Fig. 5.

The exact amount of inward movement is immaterial, and is regulated by the screw *f*, Fig. 6, which forms the stop for the inward movement of the wedges. This screw taps into the relief plate, and against its head the cross

FIG. 7—FACE VIEW OF GOVERNOR.

piece of the wedge strikes. When the handle E is turned to the left as far as it will go the wedges are back against the collars and are in proper working position. When, on the contrary, the handle is moved to the right, the screw which works through the stuffing box forces the wedges inward and throws off the relief plate. About one-half turn of the handle is all that is necessary. The handle clamps to the stem of the screw D, and is placed in such position that when down, as in Fig. 2, the wedges are back as far as the adjustment allows them to be drawn, and the relief plate and valve have their proper working bearing. This position is one of very slight pressure on the valve, just sufficient to keep the surfaces true and bright.

The purpose of this handle and screw is not for adjustment, but to afford a means of separating the valve faces from seats in case they tend to adhere together after the engine has been standing over night or longer. This "sticking" of the faces is very liable to occur with any form of balanced valve, unless loosely fitted, and it is very desirable to relieve it, which this device does perfectly, so that the engine starts with the valve entirely free and the driving mechanism relieved from any abnormal strain. After the parts are thoroughly warmed up the handle should be turned down, or back, as far as it will go.

The advantage possessed by this device is that of allowing a closer adjustment of the working surfaces than is possible where no such relief is furnished, as, without it, either flat or piston valves must be fitted freely enough to avoid binding or sticking under the conditions above mentioned, and this means a continual steam leakage, which is avoided in our arrangement. It is not strictly a necessity, and could be dispensed with, but it is regarded as a saving of steam, for the reason given, as far more than compensating for the use of this device.

The faces of valve and relief plate are at a slight angle from a vertical position, so that they lay in place when steam is off, and afford greater convenience when adjusting inside.

In case of over pressure in the cylinder, due to the presence of water, the valve is free to separate from cylinder face and allow the water to be forced into the steam chest and exhaust port the same as a plain, unbalanced slide valve, with the difference that it takes the relief plate with it. The danger of accident from water in the cylinder does not, therefore, exist in anything like the degree that it does in engines whose construction does not allow the valve to be forced from its seat under any circumstances. The bottoms of ports are slightly lower than bottom of cylinder. Both steam chest and cylinder are provided with drain cocks or valves.

The means of admitting and distributing the steam will be understood by a reference to Fig. 3. The valve A, besides taking steam at the ends, has supplemental admission ports *a a'*, which are connected at top and bottom by passages *b b'*, Fig. 4. In the position of piston shown it has passed the center at crank end and has moved a short distance toward the back or head end. The crank end of valve is open for admission of steam, which is entering cylinder port H', directly past the end of valve, and also through cavity *d''* in relief plate into port *a'*, as shown by the arrows. Steam is at the same time entering supplemental port *a* at opposite end at two points, and traveling through the horizontal passages into port *a'* and cylinder port H'. The admission, therefore, takes place at four points at the same time, and as the ports are very large the nearest approach to boiler pressure is reached and the usual loss between boiler and cylinder greatly reduced. The initial pressure is well maintained up to point of cut off, even under the heaviest loads, and the cut off takes place promptly, the closure of course being made at four points simultaneously the same as the opening.

A double exhaust is also used, as shown in Fig. 3, the valve being provided with supplemental exhaust ports *c c'*. In the position of the valve shown the exhaust steam passes from cylinder port H into cylinder exhaust passage I, in the usual way, and in addition, is passing through supplemental port *c* into central cavity K of valve, and thence into passage I, as indicated by the arrows. The provision furnishes a very large area of opening for exit of the exhaust steam, and as the opening also takes place very rapidly, the pressure drops promptly at release and is maintained at or close to that of the atmosphere, even under the heaviest loads, until the exhaust ports close for compression. The plate *e*, forming part of the valve on the relief plate side, is for the purpose of a shield to prevent the exhaust steam impinging upon the face of relief plate and wearing it by attrition so as to cause leakage. This shield does not in any way interfere with free exit of the exhaust, but, on the contrary, assists in guiding it toward exhaust passage I.

The stuffing box G is bolted to steam chest on a surface that is scraped steam tight. The stud holes are somewhat larger than the studs and the stuffing box is therefore, adjustable both vertically and laterally. This permitsa rigid connection of valve rod to valve, that will not wear loose or shackly.

The cylinder and steam chest form one casting. The back head is covered by a polished cap, which also covers the nuts, and is easily kept clean. The front head is bolted between cylinder and frame, the stuffing box being cats with the head. Both heads are made steam tight to cylinder by ground joints.

The piston is hollow, and as light as the requirements of strength will permit. It is in length equal to one-half the diameter of cylinder on all sizes, which furnishes ample wearing surface. The packing is simply narrow, cast-iron rings, turned eccentrically, and somewhat larger than cylinder, and after they are cut, sprung into corresponding grooves in piston head.

The rings do not extend all the way around, a portion of each groove at bottom being filled with a tight section of ring. These must always be left at or near the bottom in making any adjustment of the rod in crosshead. The top of piston rod is so marked near the crosshead, and this circumferential position of piston must be maintained.

As absolute rigidity, and the ability to meet without flexure or vibration, the varying strains imposed by direct thrust and by the action of the moving parts, are among the most essential requirements in securing smooth and cool running, this frame has been designed with these especial objects in view. In cross section the frame is a tapering box, wider at the base and heavily flanged at the top and bottom, the top flanges extending from the hood formed at cylinder end in a direct line to main bearings. At the crank end the frame widens out to afford an unyielding support to the journals, and the top flanges also become wider toward the boxes, the latter being cast with the frame. The frame is of unusual depth, is heavily ribbed on the inside, and has plenty of metal in it, especially at the crank end. The top flanges being at their lowest point above the bottom slides, the oil from the latter cannot run down upon the outside of frame. All the oil and drip on the inside runs down on the cross web of the frame to the crank end, and is there drawn off through a pipe. Cavities are provided for catching the oil from the main boxes, eccentric and rocker arm. The space between crank disks is covered by two shields, which prevent the throwing of oil from the connecting rod into the room. The inner shield is bolted to frame, and the outer one hinged at the bottom, so that it can be readily thrown back when desired. Both shields are of cast iron, and besides serving a useful purpose, are neat and ornamental in appearance.

The governor, Fig. 7, is of that class in which the point of cut off or valve closure is effected by moving the eccentric across the shaft, thereby varying the length of the valve travel. The movement of the eccentric is operated by centrifugal weights, the centripetal or opposing force being furnished by a

PRICE OF STOCK TO BE ADVANCED WEDNESDAY, JULY 1.

A Safe Investment, Earning 35 per cent. per Annum.

SEMI-ANNUAL DIVIDENDS APRIL AND OCTOBER.

STOCK OF THE
Ga.-Ala. Investment & Development Co.

Capital Stock, $4,500,000. Shares, $10 each, par value, full paid and Subject to no Assessments.

Gen. BENJ. F. BUTLER, of Massachusetts - - - President

Hon. JAMES W. HYATT, late Treasurer of U. S. - - Treasurer

DIRECTORS.

Gen. BENJ. F. BUTLER, of Massachusetts.
Hon. LOGAN H. ROOTS, of Arkansas.
Hon. A. U. WYMAN, ex-Treas. of U. S., of Neb.
Hon. JAS. W. HYATT, ex-Treas. of U. S., of Conn.
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Hon. JOHN B. GORDON, ex-Governor of Georgia.
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Hon. D. C. SCOVILLE, of New York City, N. Y.

SUFFOLK TRUST CO., Transfer Agents,
EXCHANGE BUILDING, BOSTON, MASS.

THE PROPERTY OF THE COMPANY CONSISTS OF

FIRST. 8000 City Lots, or 2022 acres of land in the city of Tallapoosa, Haralson county, Georgia, the residue remaining unsold of 2500 acres, on the centre of which the city was originally built. Estimated value on organization of company Oct. 1, 1890, $1,084,765, but largely increased in amount and present value since that time by additional purchases of city lands and improvements and development added.

SECOND. 2458 acres of valuable mineral land, adjacent to the city of Tallapoosa, all located within a radius of six miles from the centre of the city. Present value, $122,900.

THIRD. The issued Capital Stock of the Georgia, Tennessee & Illinois Railroad Company, chartered for the purpose of building a railroad from Tallapoosa, Ga., to Stevenson, Ala., 120 miles, that will net the company nearly $2,000,000 of the capital stock of railroad paying 7 per cent. dividends.

FOURTH. The Tallapoosa Furnace, on the line of the Georgia-Pacific Railroad, in the city of Tallapoosa, Ga.—the said furnace being of 50 tons capacity, manufacturing the highest grade of cold and hot blast charcoal car-wheel iron. Present value, $250,000.

FIFTH. The Piedmont Glass Works, situated on the line of the Georgia-Pacific Railroad, in the city of Tallapoosa, Ga., said plant being 12-pot furnace capacity, and manufacturing flint-glass flasks and prescription ware. Present value, $100,000.

SIXTH. The Tallapoosa Reclining Chair Factory on the line of the Georgia-Pacific Railroad, in the city of Tallapoosa, Ga., manufacturing hammock, reclining and other chairs. Present value, $25,000.

SEVENTH. Sundry interest bearing bonds, notes, mortgages, loans, stocks, &c., acquired since the organization of company in securing the location on its property of new manufacturing industries and from sales of its city lots and cash in bank, received from the sale of treasury stock for improvements not yet invested.

There is already located on the property of the company, in the city of Tallapoosa, from 2800 to 3000 inhabitants, three-quarters of whom are Northern people, who have settled there within the last three years, about 700 houses, 40 business houses and blocks, public parks, free public schools, churches, hotels, water works, electric lights, $75,000 hotel, now building, to be open in October. Street railway and 12 new manufacturing industries, under contract and building that will employ fully 1000 additional operatives, requiring 500 new dwelling houses, and increase the present population of the city from 3500 to 5000.

THE INCOME OF THE COMPANY.

Will be derived principally from six sources:

FIRST. Earnings of its manufacturing establishments, now in operation and to be built (now $76,235 04 yearly).

SECOND. Rentals of its farming lands and sales of timber in "stumpage" (estimated $3000 yearly).

THIRD. Sales of its city lots in Tallapoosa, Ga., for improvement and investment (estimated $250,000 yearly).

FOURTH. Working of its mines and quarries, by themselves or on "royalties" (estimated $10,000 yearly).

FIFTH. Profits on mineral, timber and town site options and purchases on line of Georgia, Tennessee & Illinois R. R. (estimated $50,000 yearly).

SIXTH. Earnings of stock of Georgia, Tennessee & Illinois R. R. (estimated $186,408 yearly).

Total estimated yearly income of company after construction of railroad, $525,633.04.

Total estimated yearly income of company prior to construction of railroad, $339,235.04.

PRESENT PRICE OF THE STOCK $3.50 PER SHARE.

TO BE ADVANCED JULY 1 TO $3.60 PER SHARE.

And further advanced Aug. 1 to $3.70, Sept. 1 to $3.80, Oct. 1 to $3.90, and October dividend, semi-annual, probably 20c. per share), Nov. 1 to $4.00, Dec. 1 to $4.10, and Jan. 1 to $4.20 per share, when it is intended to advance the price to par should any stock remain unsold.

Right Reserved to withdraw stock from sale without notice after July 1, or when 50,000 shares are sold.

The Directors of the **GEORGIA-ALABAMA INVESTMENT AND DEVELOPMENT COMPANY** have decided to offer to the public until Wednesday, July 1, a limited amount of the full paid capital stock of the company at $3.50 per share (par value $10.00).

This stock is full paid, and subject to no future assessments under any circumstances.

One million dollars of the $4,500,000 capital stock has been placed in the treasury of the company for the development of its properties, and the enhancement and protection of the interests of the stockholders.

At 12 o'clock midnight, July 1, 1891, the price of the stock of the company will be advanced to $1.60 per share, and further advanced on the first day of each month following, the sum of not less 30 cents per share until Jan. 1, 1892.

A stated advance monthly in the price of the stock has been decided on by the company for the reason that the recent location on its property of several extensive manufacturing establishments employing over 1000 skilled operatives, makes such a policy fully warranted on account of the increased values added to its assets.

The company reserves the right to advance the price of the stock more than 10c. per share per month or withdraw it entirely from sale at any time after July 1, the sales of stock and added developments shall render such action necessary for the protection of the interests of the stockholders.

Under the plan of the organization of the Company all receipts from the sale of the Treasury Stock of the Company are expended at once for improving and developing the property of the Company, increasing its assets to the extent of the amount received.

The entire properties of the company being paid for in full, all the receipts from the sale of city lots go at once to the dividend fund of the company, in addition to the earnings of its manufacturing establishments in operation and its income from other sources.

The stock of the company will not only earn gratifying dividends for the investor, but will increase rapidly in the market value, with the development of the company's property.

The stock will shortly be listed on the New York, Chicago, Philadelphia and Boston consolidated stock exchanges.

Orders for stocks will be filed as received, in any amount from one share upward, as it is desired to have as many small holders in all sections of the country as possible, who will, by their interest in the company, influence emigration to Tallapoosa, and advance the interests of the company.

Stock Sold on 2 per cent. commission, or purchased at price paid and 17 1-2 per cent. per annum profit.

For the accommodation of the stockholders of the Company, who desire to realize on their stock prior to its being listed on the Exchanges, and have not a ready market for it in their own locality, the Company have completed arrangements with a syndicate of the largest English and American stockholders to handle for a nominal commission, and buy and resell to other investors, all stock purchased of the Company. This syndicate will handle the stock at the Company's selling price, for a commission of 2 per cent., remitting to the stockholder the full amount received for same, less the commission of 2 per cent. for transacting the business, or will, if the stockholder prefers, cash the stock at any time after the first day of the month following the next advance succeeding the purchase at the price paid by the stockholder for the stock, and five cents per share (17½ per cent. per annum) additional added for each and every month thereafter until January 1st, 1892.

Stockholders wishing to sell stock purchased, can send it to the Treasurer of the Syndicate, the Suffolk Trust Company, Bankers, Transfer Agents, or to the Company direct at Boston, Mass., to be sold at the Company's selling price, less 2 per cent. commission; or if immediate cash is preferred, they will receive a check for the stock at the price paid the Company for it, and an advance of 5 cents per share added for each month it is held by them as above, without delay, on presenting their certificates of stock by mail or in person, indorsed in blank on the back of the certificate; and in view of the fact that the advance paid by the Syndicate to the person selling, when immediate cash is required is but one-half the actual advance of the stock thus affording a handsome profit for them to hold and resell at advanced prices, *the Company guarantee in selling all stock that a check as above shall in all cases be returned to parties desiring to sell without delay.*

4 ADVANTAGES ON THE STOCK AS AN INVESTMENT.

PRINCIPAL absolutely secure under all circumstances, the property being paid for in full.
DIVIDENDS, to include earnings and all receipts from sale of city lots, paid regularly, Apr. and Oct.
PROBABILITY of a large increase in each semi-annual dividends by increased earnings and sales.
CERTAINTY of a rapid increase monthly in the intrinsic value and selling price of the stock itself.

Until Wednesday, July 1, 1891.

$ 7	will purchase	2 shares or	$20 par value of stock.
14	will purchase	4 shares or	40 par value of stock.
35	will purchase	10 shares or	100 par value of stock.
70	will purchase	20 shares or	200 par value of stock.
105	will purchase	30 shares or	300 par value of stock.
210	will purchase	60 shares or	600 par value of stock.
350	will purchase	100 shares or	1000 par value of stock.
525	will purchase	150 shares or	1500 par value of stock.
1050	will purchase	300 shares or	3000 par value of stock.

Checks for the April dividend, which included earnings of the Manufacturing Establishments owned by the Company, and receipts from the sale of City lots, for the first six months of business, were mailed April 15, and checks for the Oct. dividend will be mailed to stockholders by the Suffolk Trust Co., Transfer Agents, Oct. 15.

No orders will be received at the present price of $3.50 per share after 12 o'clock midnight July 1, and all orders for stock should be mailed as soon as possible, and in no event later than several days prior to that date to insure delivery at present price of $3.50 per share.

Address all orders for stock and make checks, drafts or money orders payable to

Hon. JAMES W. HYATT, Treasurer Georgia-Alabama Investment & Development Co.
720 INSURANCE EXCHANGE BUILDING, CHICAGO, ILL.

Southern Offices, Tallapoosa, Haralson County, Ga. **New York Offices**, 11 Wall St., Rooms 31 and 32. **Boston Offices**, 244 Washington st., Rooms 8, 9 and 10. **Philadelphia Office**, Room 944 Drexel Building. **Chicago Office**, Room 720 Insurance Exchange Building. **Baltimore Office**, Room 4, Bank of Baltimore Building. **Foreign Offices**, No. 2 Tokenhouse Buildings, London, Eng.

☞ 80-page Illustrated Prospectus of Tallapoosa, Stock Prospectus of Company, and Plat of City, with Price List of Building Lots, Mineral Maps of the Section, Engineers' Reports, &c., mailed free from any of the above-named offices of the company.

Manufacturng Industries Now Building or under Contract to Locate at Tallapoosa, Ga., Secured by the Company Since the Return of the Excursion to Tallapoosa, March 1, 1891.

C. B. HITCHCOCK MFG. CO., from Cortland, N. Y., 2000 Lineal Feet of Factory Buildings, one of the largest Wagon manufacturing establishments in the world, to employ **400 to 600 hands.**

HAYES' CHAIR COMPANY, from Cortland, N. Y., 800 Lineal Feet of Factory Buildings, manufacturers of Fancy Rockers, Plush Chairs, &c., one of the largest in the U. S., to employ **125 to 200 hands.**

WM. HOWE VENTILATING STOVE CO., from Cortland, N. Y., 1100 Lineal Feet of Factory Buildings, manufacturers of the renowned Howe Patent Ventilating Stove and Ranges, to employ **125 to 200 hands.**

ANCHOR WOOLLEN MILLS, from Marysville, Tenn., 200 Lineal Feet of Factory Buildings, 2 stories, manufacturers of all kinds of Woolen Cloths, Blankets, &c., to employ **75 to 150 hands.**

BROWN BROS. & CO., from Atlanta, Ga., 75 Lineal Feet of Factory Buildings, 3 stories, manufacturers of Ready-Made Clothing, Jeans and Overalls, Underclothing, &c., to employ **50 to 100 hands.**

TALLAPOOSA STREET RAILWAY CO.; Capital, $25,000, now building, two miles of the line to be in operation by September 1.

TALLAPOOSA ICE MANUFACTURING COMPANY. Eight-Ton Artificial Ice Plant, to be in operation July 1.

IRON BRIDGE WORKS, 500 Lineal Feet of Factory Buildings, to employ **50 to 100 hands**, manufacturers of Iron Railroad and Highway Bridges.

CITY BOTTLING WORKS, from Wilkesbarre, Pa., to bottle the Lithia and Chalybeate Waters, in Lithia Springs Park, and introduce them throughout the United States.

BOOT AND SHOE FACTORY, Messrs. Horne & Boise, 3-story factory, manufacturers of all styles of boots and shoes, to employ **75 to 150 hands.**

FOUNDRY AND MACHINE WORKS, from Stanton, Mich., 100 Lineal Feet of Factory Buildings, manufacturers of Machinery, Engines, and Castings, to employ **20 to 40 hands.**

TALLAPOOSA SCHOOL FURNITURE CO., 100 Lineal Feet of Factory Buildings, manufacturers of School and Church Furniture and Fine Cabinet Work, to employ **25 to 50 hands.**

TALLAPOOSA LUMBER MFG. & R. R. CO., $250,000 Capital, 1100 Lineal Feet of Buildings. To erect Mills at Tallapoosa, and build a Logging Road into the timber south of the city to supply them with logs. Survey now being made, and under contract to commence road before July 1, to employ **150 to 300 hands.**

The above Manufacturing Industries will represent a combined frontage of over 5400 LINEAL FEET, OR OVER A MILE OF FACTORY BUILDINGS, *employ when completed from 1,000 to 2,000 operatives, according to the business done, and require 500 new dwelling houses erected at once.*

single spiral spring. The peculiar features of the governor are its simplicity and small number of joints, the adjustment of the spring for sensitiveness, and that the direction of the pull of the spring is such as to bring the bearings upon the pivot pins always on the same side, whether the weights be moving outward or inward, thus avoiding all lost motion and rattling due to either wear or loose fitting.

Fig. 9 is a side elevation of the governor. The weight A is bolted to the eccentric arm, and is therefore pivoted to fly wheel at B, the same point as the eccentric itself. The weight A′ is adjustable on the lever D, which is pivoted to fly wheel at B′, and connected to eccentric C, through the link E. Rubber buffers (not shown) at point *a* and point *b* form stops for the extreme inward position of the weights, and the one at *c* for the extreme outward position.

In the position shown, the weights are at their extreme inward point of movement, the center of eccentric being at *d*, and corresponding to point of cut off by the valve at three-fourths stroke. In the extreme outward position of weights the center of eccentric is moved to *e*, where the eccentric gives to the valve its least travel, the point of closure or cut off being at zero. This whole range is under absolute and immediate control of the regulator, with equal precision at all points of cut off.

The spring F is pivoted to the eccentric at G, upon a knife-edge bearing. The spring head is a forging screwed into the spring, and the support for knife edge is made separately, and inserted in place. The knife edge itself is inserted in the pin, which is securely fastened to the eccentric. The knife edge and its support are made of hardened tool steel, so that both wear and friction are entirely eliminated from this important pivot, which receives greater pressure than any of the others. It, of course, requires no oiling.

The outer end of the spring is secured to the wheel in such a manner as to permit of a lateral adjustment of the former along the rim of the wheel, allowing the spring to be swung around on its pivot G, to a point nearer to or further from the main pin B, and forming thereby a more or less acute angle, with a line drawn from its point of support G to B. The bolts *k k′* screw into the rim, and pass through slotted holes in the slide *f*, which permit of the necessary amount of movement of the slide and spring. The effect of this arrangement is to make the governor more or less sensitive as desired, the fine adjustment securing for the engine the closest possible regulation.

In all governors of this class the conditions required for perfection of regulation are, that the power due to the centrifugal force of the weights as they move outward shall increase in exactly the same ratio as does the power of the spring. When the force of the spring, as the weights move outward, increases faster than the centrifugal force of the weights, there will be too great a difference in speed, as between light and heavy loads or varying steam pressures. On the other hand, if the conditions are reversed, and the effective power of the spring increases too slowly to meet the increasing centrifugal force of the weights, the action of the governor will be unsteady and the engine will pulsate, or "race," as it is called. Owing to a lack of uniformity in springs of the same size, no one position with equal tension is correct for all cases. One method, and the usual one for correcting this difficulty when good regulation is attempted, is to locate the spring arbitrarily and secure greater sensitiveness by increasing the tension of the spring (loading or shifting the weights at the same time) until acceptable regulation is obtained. The objection to this proceeding is that more tension is put upon the spring than is necessary for proper power in the governor, and this means an undue amount of pressure upon the pins, causing unnecessary friction and rapid wear of the surfaces. This method is to give the spring sufficient tension to furnish ample power for the governor, and to secure the required degree of sensitiveness by allowing it more or less leverage or effective force. An inspection of Fig. 7 will show that as the outer end of the spring is moved upward from the position shown, thus bringing it to the pin B, its effective force or leverage is lessened, and an adjustment in the opposite direction has the reverse effect. In adjusting the position of the spring, after giving it sufficient tension, which is obtained by the screw at the outer end, if there is too much difference in speed under varying loads and pressures, the slide *f* is moved to carry the spring towards the eccentric pivot B. Just inside the racing point is the proper place to fix the adjustment.

The adjustments of the governor are made at the works, the engines being put into actual operation, and tested thoroughly under varying conditions, and, therefore, no changes are necessary. If a different speed is ever required, it may be obtained by changing the spring tension, if the change of speed desired is a slight one. If it is to be over, say, 5 per cent. either way, we would advise adding to or taking from the weights, or within certain limits, moving the weight A′. Greater spring tension or lighter weights give increased speed, and *vice versa*.

In most of the fly-wheel governors on the market two springs are used. Owing, however, to the lack of uniformity in springs, before mentioned, and which precludes selecting two that are just alike, the use of a single spring greatly simplifies the adjustments described, and makes a certainty of securing the conditions required for the best results. The parts are most substantially made and fitted, the pins being of hardened steel, with bronze bushings for bearings, and with proper provision for lubrication.

As will be noticed by the cut, provision is made for changing the weights so as to run the engine in the opposite direction.

The shaft A and pin B are formed with the cranks in one solid steel forging. The counterbalancing disk, the outside of which is concentric with the shaft, is secured to the crank by a wrought iron clip, which passes around the end of the crank, extending through the disk, and having threaded ends for the nuts, which, when tightened, seat the disk and shaft firmly together. The crank is turned off for a short distance on each side concentric with the shaft, and the disk bored to correspond, which forms a true and permanent seat. The central space or recess cored in the disk is filled with soft metal, which fits closely against the shoulders in crank, formed at the ends of the turning, establishing the permanent longitudinal position of the disk. By this construction there is secured the important advantage of removable disk, which is a feature greatly appreciated if at any time it is desired to true up the crank pin. he disks can be readily removed after unscrewing the clip nuts, and the pin can then be trued up in a lathe. This is an improvement over the usual method of filing the pin by hand. The disks are not only removable, but when replaced they return to precisely their original position in every direction, and will run true with the shaft.

This disk has less weight on the crank side than any other in use, and consequently requires less on the opposite side to obtain the required counterbalance. Its form permits of easy access to the crankpin boxes and affords ample room for their adjustment.

The inertia of the reciprocating parts is a subject of interesting study for the engineer, and has of late years received more attention than was formerly given it. It may be stated that the vibratory action due to the inertia of the reciprocating parts is effectually neutralized by the counterweight in disks, the consequent horizontal strains being thus transferred into a vertical direction, where they are met by the foundation and transmitted to the solid earth.

The relative weight of counterbalance to that of the reciprocating parts has been determined for this engine by a series of experiments throughout the entire range of speed and with changeable counterweights. The proportions adopted are such as to secure perfect smoothness of action and an entire absence of vibration under the different conditions of load, speed and steam pressure. The engines are tested for this quality by loosening the foundation nuts, and, with the belt off, running the engine up to speed. With the proper amount of counterbalance no vibration or tendency to longitudinal movement is shown, the engine running as steadily as when bolted down. The upper view in Fig. 8 shows the top of crosshead, and the lower one is an end view, the piston rod being in section. The body A of the crosshead is made hollow for lightness, and the hub B is secured to same by the two bolts C, which tap into crosshead. The holes in hub are made somewhat larger than the bolts, and after the alignment of piston rod is made and the bolts screwed up in place, the space around each bolt is filled with lead or other soft metal. The hub, which is very long where piston rod passes through, is threaded for one-half of its length for the rod. It is split horizontally between the bolts C, as shown in the lower view, and the two bolts D clamp it firmly to the rod. The pin is flattened at top and bottom, and the boxes are cut away to correspond. The advantages of the separable crosshead are three-fold, and are stated to be as follows:

1. It allows the pin to be turned in an ordinary lathe, thus securing true surfaces when new and enabling the pin to be returned if it ever becomes necessary.

2. The alignment of piston rod in construction is simplified and greater accuracy insured, as the hub is adjustable in each direction before the spaces around bolts are filled, instead of occupying an arbitrary position.

3. It enables the vertical adjustment of piston rod to be made, should the wear of the piston or crosshead in course of time appreciably alter their relative vertical positions. While the proportions of wearing surfaces are such that ordinarily the downward wear of piston and crosshead are about equal, conditions may arise whereby the crosshead will wear faster than the piston and *vice versa*; should either of these occur, the adjustment can be made by taking out the bolts C, removing the soft metal and making the proper realignment, and pouring soft metal again around the bolts after they are screwed up in place.

The clearance between piston and cylinder head is kept practically equal at each end by turning the piston rod in crosshead one revolution at a time, when the wear of the connecting-rod boxes requires it. The operation of loosening the clamp bolts, turning the rod and tightening the bolts again is a very simple one, and the adjustment can be quickly made.

The construction of main connecting rod will be readily understood by an inspection of Fig. 9. The body of the rod A is of I section, a form securing the maximum degree of stiffness with minimum weight, and tapers in depth, as shown, from crosshead to crank pin end. The strap B is secured in position by the key bolt C, which binds it firmly to the butt and performs the additional function of providing adjustment for wear. The key, which is of double wedge form, bears against the strap at top and bottom in front, and against the butt end of rod on the back. The upward movement of key will obviously draw the strap forward and the wearing surfaces closer together. The washers *a b* are hollow, or cup shaped, and receive the tapering portions of the key. The butt and strap are bored out for the babbitt metal bushings *c c′*, which are held in position by the babbitt anchors *d* These anchors are poured after bushings are placed in positions.

The construction is alike at the crank pin and the crosshead ends.

It will be noticed that the bushings or linings have no flanges at the ends, the butt and strap being in width equal to the length of the pin, and the bushings are, therefore, supported their entire length. The rounded portion of strap is thickened to give it greater stiffness and to receive the working strains without springing. This insures the boxes being perfectly supported at all times under the heaviest duty, which operates to secure greater durability of the wearing surfaces and cool running.

A highly advantageous feature of this rod is in the fact that the end of butt, being semicircular in form, surrounds one-half of the pin, and the inner half of box or bushing receives its vertical support from the rigid butt instead of from the strap, the latter being the case with the ordinary construction, in all of which the straps are more or less elastic. The hinging action or springing of the ordinary strap, which takes place at high speed, produced by the rapid up and down motion of the crank pin, is avoided in this construction, as will be apparent by comparing it with the ordinary strap joint. This feature is of importance and value, and gives it no small share of credit for the uniform coldness with which this crank pin runs. The rod in this respect possesses the advantage of the "English" connection, which is a vertical half box

bolted to end of butt In this rod, however, less weight is required at the butt, and the adjustment for wear is much easier made.

As the key cannot fly out, and there is no set screw to break or twist off, this rod is safer than the ordinary gib and key connection, especially when the latter is used at the crank pin ends. It possesses in a marked degree the elements of strength, rigidity and lightness, all of which are important factors in the securing of successful and satisfactory operation.

The main bearings on each side of the crank are cast solid with the frame, and the caps are placed at an angle of 30° from a vertical line. Set screws passing through the cap and having their bearing against the outside of box form stops to prevent the cap from pinching the shaft, so that the cap can be bolted down hard and leave the shaft entirely free. A gib at the top furnishes means of vertical adjustment, so that the downward as well as the side wear of journals and boxes is provided for, and the adjustments are made in the direction that the wear takes place. The surfaces are so large and well fitted, however, and the journals and boxes made from materials of such excellent wearing qualities, that the wear is very slow.

The linings for the main boxes are similar to those used in the connecting rod, except that they are of uniform thickness, and they are secured in place by anchors in the same manner. The box and cap are bored out to receive the linings. Any soft metal will answer for the anchors, which are poured after the lining is placed in position. The linings are made in molds and are uniform in size, and the renewal of main box bearings becomes a simple matter. The anchors hold the linings firmly in position, giving them a solid backing over the entire surface, the same as though they were in one piece with the frame and cap.

It will be seen from the foregoing description that the valve adjustment provided allows steam tightness to be maintained throughout the lifetime of the engine. This is a feature of the greatest importance, for it is a well-known fact that the large steam consumption or poor economical showing of many engines, both high and low speed, must be in a great measure charged to valve leakage. With the majority of valves renewal or scraping is the only remedy, either of which affords but temporary relief. This valve is not partially, but wholly balanced, and, with the proper adjustment, works in entire equilibrium. There being no pressure upon the faces, the wear is very slight, but, slight as it is, it must be provided for to maintain the steam tightness that is necessary to secure the best economy. This method of adjustment effectually does this.

In regard to regulation this engine is stated to be decidedly superior.

The adjustment with which the governor is provided, by changing the position of the spring, allows the nearest approach to isochronism, or perfection of regulation. This is a condition in which the speed would be absolutely the same under all loads and pressures. The nearest realization to this state of perfection is just inside the point at which vibration or "racing" appears, and this is secured in our engine by the spring adjustment, as already described.

Tests made by the well-known engineer, Geo. H. Barrus, of Boston, show that this claim is founded upon the actual performance of the engines.

These desirable qualities go hand in hand, and result from the liberal wearing surfaces provided at all points, combined with a careful and workmanlike fitting of all rotating and sliding surfaces, and the selection of the best wearing materials.

NEW ENTERPRISES.

A machine shop 108x40 feet is in course of erection, at Barre, Vt, by Whitcomb Brothers.

Jackson Bros. will erect a foundry and machine shop, 100x40 feet, at Hillsborough, N. H.

The Standard Nut Lock Co. has been incorporated at Detroit, Mich., with a capital of $100,000.

The Blodgett Balance Power Engine Co. has been organized, at Chicago, to make the Blodgett engines.

The Minneapolis Rolling Mill Co. is the name of a new concern recently organized at Minneapolis, Minn.

A steel plant is contemplated at Strasburg, Va., by W. G. Carroll, who, it is reported, has leased land with that end in view.

A movement is on foot at Scranton, Pa., to build a wire-drawing plant and nail factory. James Nolan is the originator of the enterprise.

The Wheeland Automatic Fire Escape Co. is a new concern organized at Chicago, to manufacture fire escapes on the Wheeland patent. Capital $250,000.

The Standard Boiler & Bridge Works, of Bellaire, O., has been chartered for the purpose of doing a general boiler and bridge manufacturing business.

The Corrugated Wheel Co., of Chicago, Ill., has been incorporated, with a capital stock of $100,000; incorporators, W. E. Williams, G. B. Lathrop and S. T. Edwards.

A new concern, known as the Horton Machine Co., has been started at Holyoke, Mass., by M. H. Whitcomb and others, to manufacture emery grinding machinery.

The Stearns-Roger Manufacturing Co. has been incorporated in Denver, Col., with a capital of $250,000, to take over the business of Stearns, Roger & Co., manufacturers of mining machinery, with works at Pueblo.

The National Malleable Iron Co., of Peoria, Ill., has been incorporated to manufacture malleable iron and machinery. The capital stock is $100,000. The incorporators are: A. Henry, A. C. Angler and Geo. A. Willson.

A company has been organized at Milwaukee, Wis., to manufacture a malting machine, patented by John W. Free, of New York, who is at the head of the general company controlling the patents. The company will be known as the Wisconsin Free Malting Co., and its capital stock will be fixed at $500,000 or $1,000,000. A factory will be erected for the manufacture of the machines.

The Murray Metallic Packing Co. has been incorporated at Albany, N. Y., with a capital stock of $25,000. The shares are $100 each. The object of the company is to manufacture and sell metallic packing, to be used in engines, pumps and machines of a similar nature. The directors are: Edward J. Murray, Timothy J Sullivan, Frederick J Hinckel, William E. McEwen and Edward A Maher. The office and works of the company will be in the Electric Illuminating Building, on Trinity place.

Excursion to Ft. Wayne, Ind.,

Via Nickel Plate, June 23d to 26th. Knights of St. John Annual Convention. Returning until June 29th, 1891. Go via Nickel Plate.

Convention of Knights of St. John

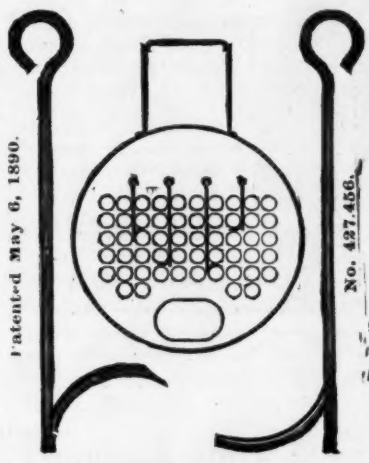
At Ft. Wayne, Ind. Go via Nickel Plate at special reduced rates, June 23 to 26. Returning until June 29th, inclusive.

THOUSANDS of Knights in one day will congregate at Ft. Wayne, Ind., at Knights of St. John Convention. Go via Nickel Plate. Special cheap rates.

BUSINESS OPPORTUNITY.

Phoenix Iron Works of Cleveland, Ohio, for sale. Manufactures Hoisting Machinery and Steam Engines. Good, established business. Small capital needed. Public sale June 19th if not sold sooner. Address,

F. A. QUAIL, Assignee, 219 Superior St., Cleveland, O.



TO USERS OF TUBULAR
BOILERS

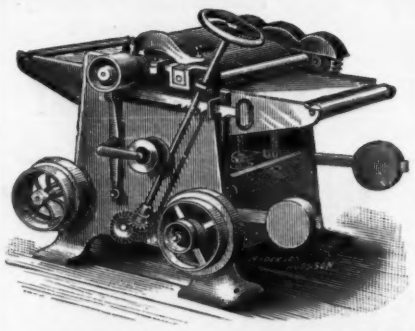
Why you should use Bauer's External Flue Scraper, as it is the only known device that removes the scale and sediment from the outside of the flues.

B 1st. Removes scale from the external surface of the flues.
E 2d. Saves flues from collapsing and overheating.
C 3d Gives absolute protection to flues from scaling.
A 4th. By removing this scale from the flues and boiler head, saves flues, extra fuel and repairs.
U 5th It will save its price the first time it is used
S 6th. A set should be in the hands every engineer.
E 7th. Price $10 a set of 5 pieces, are sent on 30 days' trial. Send outside diameter of flues.

Send for circular of both the Scraper and of our Sensible Automatic Packing.

Sensible Automatic Packing Co.,
63 South Canal St., CHICAGO, ILL.

FRANK & CO., BUFFALO, N. Y.
MANUFACTURERS OF
Band Saws, Scroll Saws, Universal Saw Benches,



Saw Mandrels, Pony Planers,
Matchers, Friezing Machines,
Shafting, Pulleys, Hangers,
Couplings, Wood Turning and
Pattern Makers' Lathes.

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S. T. W. Ejector.

For Raising Water from Deep Wells, Streams, Excavations, &c.

The cheapest made. Send for prices.

JAMES JENKS,
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Plate Iron Washers
ASPECIALTY!
Even in Guage, smooth and well finished.

Cut from new plate, rolled expressly for the purpose. Write for prices, Address,

MILTON MFG. CO., Milton, Pa.

INDUSTRY FILE WORKS,
A. & H. Gough, Props.,
Manufacturers of
Files and Rasps,
Equal to the Best English File.
OLD FILES RE-CUT.
All Kinds of Job Grinding.
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Mention this paper.

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ROBERT AITCHISON
PERFORATED METAL CO.
CHICAGO, ILL.

PERFORATED METALS OF ALL KINDS

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WORKS AT SOUTH CHICAGO.

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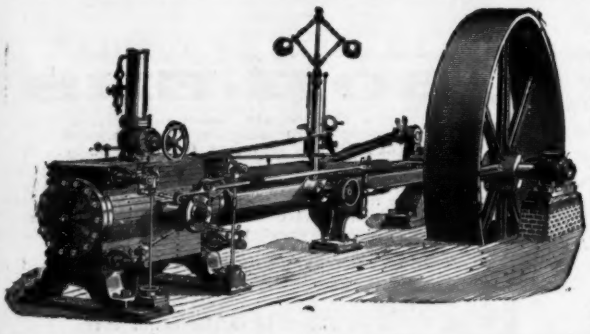

Iron and Wood Working Machinery of every description; Corliss Engines and Boilers; Shafting Pulleys and Hangers.

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MANUFACTURERS OF PERFORATED METALS FOR SUGAR HOUSES, DISTILLERIES, PHOSPHATES AND FERTILIZING WORKS, RICE MILLS, COTTON SEED OIL MILLS, PERFORATED METALS

ELEVATORS, MALT KILN FLOORS, GRAIN DRYERS, SEPARATORS, CORN SHELLERS AND ALL KINDS OF GRAIN CLEANING MACHINERY. ALSO, FOR MINING AND CONCENTRATING WORKS, COAL, COKE AND ORE SCREENS. GAS AND WATER WORKS, PAPER, WOOLEN, FLOUR AND OIL MILLS, FILTERS, STRAINERS, VENTILATORS, ETC. HEAVY STEEL AND IRON PLATES AND CYLINDERS FOR SCREENING ORE, COAL, STONE, PHOSPHATES, ETC. REVOLVING SCREENS, ROUND AND HEX AGON, GRIZZLIES FOR PLACER MINING, STAMP BATTERY SCREENS OF ALL KINDS AND SIZES. SCREENS FOR ALL KINDS OF ORES. SPECIAL ATTENTION GIVEN TO WORK FOR RAILROADS, AND CAR BUILDERS. PERFORATED TIN AND BRASS OF ALL SIZES.

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224 & 226 NORTH UNION ST CHICAGO, ILL. U.S.A.
PERFORATED BRASS. PERFORATED TIN.
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TIME IS MONEY!
SAVE TIME AND MONEY BY USING OUR SPECIALTIES.

OUR
Time Stamps

Mark the hour and minute, the day, month and year, by one impression.

Useful, Economical, Ornamental.

PRINTED MATTER ON APPLICATION.

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Time Registers

Record the hour and minute of the arrival and departure of employes by their own act, in their own handwriting.

Indispensable for employers and just to employes.

THE AUTOMATIC TIME STAMP AND REGISTER COMPANY
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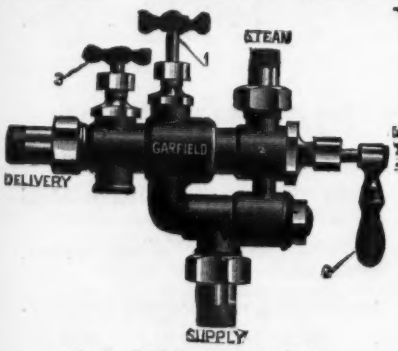
WADSWORTH, O.,
—MANUFACTURERS OF—



The Garfield Double Jet Injector.

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Double Jet Injector
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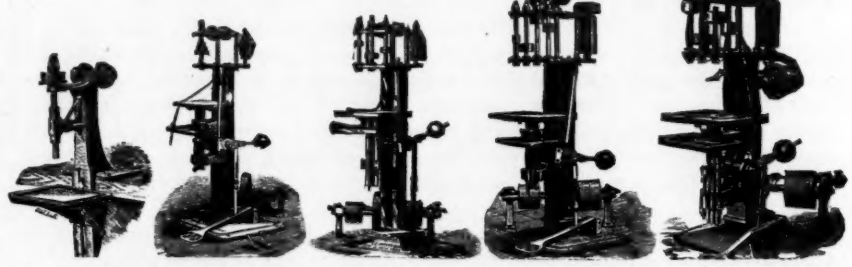

Light Bench or Post Drill. | No. 1 Drill Press. 1 or 2 Spindles. | No. 2 Drill Press. | No. 3 Drill Press. | No. 4 Drill Press.

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Manufacturers of, and Dealers in, all kinds of
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Universal and Plain Milling Machines, Drill Presses, Screw Machines, Hand and Engine Lathes, Planers, Profilers, Chucking Machines, Gear Cutters, Die and Cutter Grinders, Tapping Machines, Wire-Spring Coilers, Milling Cutters, etc.

Plants for Manufacturers of Sewing Machines and Electrical Goods.
GEAR CUTTING AND MILLING IN ALL ITS BRANCHES.
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HOISTING & WINDING ENGINES
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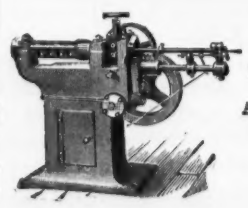

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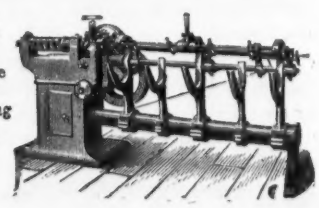
Builders of Machinery for Hardware Manufacture.
Automatic Wire Straightening and Cutting Machines, Butt Milling Machinery, Butt Drilling Machinery, Riveting Machines, Foot Presses, Sprue Cutters, Etc.



The Wock Patent Slip Joint Eaves Trough, 10 ft. 2 in. Long, Without a Seam.

Steel and Wire Hangers, Etc.

THE BELDING PATENT LOCK SLIP JOINT TROUGH, Manufactured by **THE CANTON STEEL ROOFING CO., Canton, O.**

IRON AND STEEL MARKETS.

PIG IRON.

CLEVELAND (f. o. b. cars, net cash) Bessemer, $17 30; No. 1 Foundry, $16 80; No. 2 Foundry, $15 80; No. 1 Gray Forge, red short, $14 80; No. 2 Gray Forge, neutral, $14 30; No. 1 American Scotch, $16 80; No. 2 American Scotch, $15 80.

CHICAGO (reported by Messrs. Rogers, Brown & Merwin): Southern Coke No. 1 foundry, $16 25 @17 00; Southern Coke No. 2 Foundry, $15 50 @16 50; Southern Coke No. 3 Foundry, $15 00 @16 00; Southern Coke No 1, Softeners, $15 50 @16 50; Southern Coke No. 2, Softeners, $14 75 @15 50; Ohio Silveries No. 1, $17 75@18 75; Ohio Silveries No. 2, $16 75@ 17 75; Ohio Strong Softeners No. 1, $18 00@19 00; Ohio Strong Softeners No. 2, $17 25@18 25; Lake Superior Charcoal Nos. 1 to 6, $18 00@18 50; Tennessee Charcoal No. 1, $18 00@19 00; Tennessee Charcoal No. 2, $17 50@18 50; Southern Standard Car Wheel, $21 00@23 00; Tennessee Standard Car Wheel, $00 00@00 00.

CINCINNATI (reported by Rogers, Brown & Co.): FOUNDRY IRONS—Southern Coke, No. 1 foundry, $15 00@15 25; Hanging Rock Coke, No. 1 foundry, $16 50@17 50; Jackson Co. Stone Coal, No. 1 foundry, $16 50@17 00; Tennessee Charcoal, No. 1 foundry, $16 50@17 50; Hanging Rock Charcoal, No. 1 foundry, $20 00 @22 00. MILL IRONS—Standard Southern Coke, grey forge, $13 00@13 50; Standard Southern Coke, mottled, $12 50@12 75; Cold Short Southern Coke, grey forge, $12 75@13 00; Strong Ohio Neutral Coke, grey forge, $15 00@15 50. CAR WHEEL AND MALLEABLE—Standard Alabama Car Wheel, $20 00@20 50; Tennessee Car Wheel, $18 50@19 50; Lake Superior Car Wheel, $19 50@20 50.

BUFFALO (reported by Rogers, Brown & Co.): Mahoning and Shenango Valley strong, No. 1 Foundry, $17 00@00 00; Mahoning and Shenango Valley strong, No 2 Foundry, $16 00 @00 00; Ohio Softener No. 1, $17 00@00 00; Ohio Softener No. 2, $16 00@00 00; Jackson Co., Silvery No. 1, $18 25@00 00; Jackson Co. Silvery, No. 2, $17 25@00 00; Lake Superior Charcoal, $18 50@00 00; Tennessee Charcoal, $18 50@00 00; Southern Softener No. 1, $16 25@00 00; Southern Softener No. 2, $15 50@00 00; Southern Strong No. 1 Foundry, $17 00@00 00; Southern Strong No. 2 Foundry, $16 25@00 00; Alabama Car Wheel, $22 00@22 50; Hanging Rock Charcoal, $23 00@24 00.

LOUISVILLE (reported by Hall Bros. & Co.) HOT BLAST FOUNDRY—Southern coke No. 1, $14 25@14 50; Southern coke No. 2, $13 75@14 00; Southern coke No. 3, $13 25@13 50; Mahoning Valley (Lake ore mixtures), $00 00@00 00; Southern charcoal, No. 1, $16 50@17 00; Southern charcoal, No. 2, $16 00@16 50; Missouri charcoal, No. 1, $17 00@17 50; Missouri charcoal, No. 2, $16 50@17 00. FORGE—Neutral coke, $12 50@13 00; Cold short, $12 50@13 00; Mottled, $12 00@12 25. CAR WHEEL AND MALLEABLE—Southern (standard brands), $19 50@ 20 00; Southern (other brands), $17 50@18 00; Lake Superior, $20 50@21 50.

ST. LOUIS (reported by Rogers, Brown & Meacham): HOT BLAST COKE AND CHARCOAL—Southern Coke No. 1, $15 50@15 75; Southern Coke No. 2, $14 75@15 00; Southern Coke No. 3, $14 00@14 25; Southern Grey Forge, $13 50@ 13 75; Southern Charcoal No. 1, $17 75@18 00; Southern Charcoal No. 2, $17 25@17 50; Missouri Charcoal No. 1, $15 50@16 00; Missouri Charcoal No. 2, $15 00@15 50; Ohio Softeners, $18 00@ 19 50. CAR WHEEL AND MALLEABLE IRONS—Lake Superior, $20 00@20 50; Southern, $19 00@ 21 00. CONNELLSVILLE COKE—East St. Louis, $0 00; St. Louis, $0 00.

DETROIT (reported by William F. Jarvis & Co.): Lake Superior Charcoal, all Numbers, $18 00@18 50; Lake Superior (coke) Bessemer, $18 00@18 50; Katahdin (Maine charcoal), $23 50 @24 00; Lake Superior Coke, Foundry, all ore, $18 00@18 50; Lake Superior Coke, Foundry, all ore, $00 00@00 00; Standard Ohio Black Band, $18 00@18 50; Southern No. 1 $16 25@16 50; Southern Gray Forge, $14 00@ 14 50; Jackson County (Ohio) Silvery, $18 25@ 18 75; Old Car Wheel, $00 00@00 00. Connellsville Coke, $0.00.

LOUISVILLE (reported by Geo. H. Hull & Co.): Southern Coke No. 1 Foundry $14 50@ 15 00; Southern Coke No. 2 Foundry $13 75@ 14 25; Southern Coke No. 3 Foundry $13 25@ 13 75; Grey Forge, $12 75@13 25; Southern Coke Silver Grey, $00 00@00 00; Southern Charcoal No. 1 Foundry, $16 00@17 00; Car Wheel, $17 00@20 00.

PITTSBURGH (reported by A. H. Childs): No. 1 Foundry, $16 00@16 25; No. 2 Foundry, $15 00@16 25; Grey Forge, $14 00@14 25; White and Mottled, $13 00@13 50; Warm Blast Charcoal, $18 00@20 00; Cold Blast Charcoal, $22 00 @27 00; Bessemer, $15 75@16 00.

MERCHANT IRON AND STEEL.

Flat Bar

1½ to 4 by ⅛ to 1 inch	1 80
4½ to 6 by ⅛ to 1 inch	1 90
1½ to 6 by 1⅛ to 2 inch	2 20
1¼ & 1½ by ⅛ to ¼ inch	1 90
1 & 1¼ by ⅛ to ¼ inch	2 00
⅛, ¼ and ⅜ by ⅛ to ½ inch	2 20

Round and Square.

1 to 1⅛ inch	1 80
2 to 2⅛ inch	2 00
2¼ to 3½ inch	2 30
3⅝ to 4 inch	2 80
4¼ to 4½ inch	3 30
4⅝ to 5 inch	3 50

Oval.

⅜ to 1¼ inch	2 20
⅛ to ¼ inch	2 40
⅛	2 60
⅜	3 00

Half Oval and Half Round.

1⅛ to 3 inch	2 90
⅜ to 1¼ inch	2 50
⅛ to ¼ inch	3 10
⅛	3 30
⅛	4 80

Heavy Band.

¼ to 6 by ¼ and 5-16 inch	2 00
¼ to 1⅜ by ¼ and 5-16 inch	2 10
½ to ⅝ by ¼ and 5-16 inch	2 30
⅝ to ⅞ by ¼ and 5-16 inch	3 80

Hoops.

1¼ to 4, Nos. 13 to 15	2 60
1¼ to 2, Nos. 16 to 18	2 70
1¼ to 2, No. 19	2 80
1¼ to 2, No. 20	2 90
1¼ to 2, No. 21	3 00
1¼ to 2, No. 22	3 10
15-16, 1 and 1⅛, Nos. 13 to 15	2 80
15-16, 1 and 1⅛, Nos. 16 to 18	2 90
15-16, 1 and 1⅛, Nos. 19 and 20	3 00
15-16, 1 and 1⅛, No. 21	3 10
15-16, 1 and 1⅛, No. 22	3 20
⅞, Nos. 13 to 15	3 00
⅞, Nos. 16 to 18	3 10
⅞, Nos. 19 and 20	3 20
⅞, No. 21	3 30
⅞, No. 22	3 40
13-16, Nos. 13 to 15	3 20
13-16, Nos. 16 to 18	3 30
13-16, Nos. 19 and 20	3 40
13-16, No. 21	3 50
13-16, No. 22	3 60
¾, Nos. 13 to 15	3 30
¾, Nos. 16 to 18	3 50
¾, Nos. 19 and 20	3 60
¾, No. 21	3 70
¾, No. 22	3 80
11-16, Nos. 13 to 15	3 50
11-16, Nos. 16 to 18	3 70
11-16, Nos. 19 and 20	3 80
11-16, No. 21	3 90
11-16, No. 22	4 00
⅝, Nos. 13 to 15	3 80
⅝, Nos. 16 to 18	4 00
⅝, Nos. 19 and 20	4 10
⅝, No. 21	4 20
⅝, No. 22	4 30
⅝, No. 23	4 50

Light Band.

1⅛ to 6 by ⅛ to 3-16 in	2 20
1⅛ to 6 by Nos. 11 and 13	2 30
1 to 1⅜ by ⅛ to 3-16 in	2 40
1 to 1⅜ by Nos. 11 and 12	2 50
⅞ and 13-16 by ⅛ to 3-16 in	2 70
⅞ and 1 3-16 by Nos. 11 and 12	2 80
¾ and 11-16 by ⅛ to 3-16 in	3 00
¾ and 11-16 by Nos. 11 and 12	3 10
⅝ and 9-16 by ⅛ to 3-16 in	3 30
⅝ and 9-16 by Nos. 11 and 12	3 40
½ by ⅜ to 3-16 in	3 60
½ by Nos. 11 and 12	3 70

Wagon Box Iron.

⅜ inch, beveled edge, by Nos. 11 and 12	2 80
⅜ inch, " " " 13 and 14	3 00
¼ inch, " " " 11 and 12	3 10
¼ inch, " " " 13 and 14	3 30

Sheet Iron.

No. 10 to 14	2 65
No. 15 to 17	2 75
No. 18 to 21	2 99
No. 22 to 24	3 15
No. 25 to 26	3 30
No. 27	3 40
No. 28	3 50

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 60
C No. 1, " "	2 85
C H No. 1 " "	3 10
C H Flange, " "	3 85
Extra Flange, "	4 35
Solid Fire Box "	5 10

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 75
Shell	3 15
Flange	3 45
Marine Flange	3 85
Fire Box	4 55

Above includes plates 90 inches wide.

90 to 96 in. wide	⅛c lb extra
96 to 100 in. wide	1 c "
100 to 104 in. wide	1⅛c "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs
1 to 2 in. inclusive	09
9-16 to ⅞ in "	09
7-16 to ⅝ and 2⅛ to 3 in	10½
3⅛ to 4 in	11
⅛ to 11-16 and 4⅛	10½
⅛ to 6 in	11½
¼ to 9-32 and 6¼ to 7 in	13
3-6 in	14

Flats.

	cts. lbs
2 to 9-16 wide by 2 to ⅝ thick	9

Bessemer and O. H. Steel.

Machinery	base price.	2 75
Tire	"	2 75
Spring	"	3 25
Sleigh Shoe	"	2 75
Toe Calk	"	3 00
Cutter Shoes, tapered and burr.	"	3 00

English Tool Steel.

Jessop's	16c
Hobson's "Best"	16c
" "Choice"	15c

Burden Boiler Rivets.

⅛, ¼, 11-16 and ⅝ inches diameter	4 00
Bridge ⅛, ¼, 11-16 and ⅝ inch diam	4 00

SCRAP IRON AND OLD METAL.

NET TONS

No. 1 R. R. wrought scrap	$19 00
No. 1 wrought scrap	17 00
No. 1 Machine cast scrap	12 00
Iron axles	24 00
Axle turnings	13 50
Wrought turning (free from cast)	12 00
Cast borings	8 00
Uncut wrought iron boilers	11 00
Steel boiler plates	17 00
Grate Bars	8 00
Pipes and flues (Clean)	13 50
Tank iron	13 50
Hoop and band iron	10 00
Sheet iron	9 50
Wrought drillings	11 00
Malleable iron	10 00

Reported by Messrs. BLACK & POLLOCK, Cincinnati, O.:

Railroad Wrought	$20 00
No. 1 Country Wrought	17 00
Stove Plate	8 75
Machine Castings	11 00
Hoop and Sheet	8 00
Casting Borings	9 00
Wrought Turnings	12 00

CLEVELAND ROLLING MILL CO.,

MANUFACTURERS OF

BESSEMER STEEL RAILS,

Blooms and Billets, Steel Angles, Forgings, Bar and Spring Steel, Steel Street Rails, Steel Oil Barrel Hoops, Wire of all Kinds, Iron and Steel Boiler Plates, Galvanized and Black Sheet Iron, Corrugated Iron Roofing, Sheet Steel.

THE CAMBRIDGE IRON & STEEL CO.

MANUFACTURERS OF

SHEET IRON AND SHEET STEEL

Squared Roofing Sheets a Specialty.

CAMBRIDGE REFINED IRON. TRADE MARK

CAPACITY RANGES FROM No. 30 26 INCHES WIDE TO 1-4×40×120

CAMBRIDGE SOFT STEEL. TRADE MARK

CORRESPONDENCE SOLICITED

OFFICE AND WORKS CAMBRIDGE, OHIO.

Magnetic Concentration of Iron Ore.

Ball-Norton (Monarch) Electro Magnetic Separator.

Phosphorus, sulphur, silica, hornblende and other impurities eliminated from Iron Ore, and non-Bessemer ore converted into Bessemer Ore. Samples treated without charge. Correspondence solicited.

H. E. COLLINS & CO., Agents Magnetic Separator Co.,

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DALLIBA, CORRIGAN & CO.,

DEALERS IN

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Rooms 716, 717, 718, 719 Perry-Payne Bld'g.

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PITTSBURGH & WHEELING COAL CO.,

MINERS AND SHIPPERS OF

Ohio Steam Coal and Coke.

Mines on the Cleveland, Lorain & Wheeling R. R. Capacity, 3,000 tons daily.

Office, 6 Mercantile Bank Building,

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Lake Shipping Point, Lorain O

JAS. PATTERSON, Sales Agent.

OGLEBAY, NORTON & CO.,

Successors to Tuttle, Oglebay & Co.,

Commission Dealers in

Iron - Ores,

FROM MARQUETTE, GOGEBIC AND MENOMINEE DISTRICTS,

CLEVELAND, OHIO.

ESTABLISHED 1854.

PETER GERLACH & CO.,

MAKERS OF

Saws, Tools and Machinery.

Office and Warerooms, 28 Columbus st. Factories on Columbus, Winter and Leonard streets.

Cleveland, O., U. S. A.

J. H. OUTHWAITE. W. G. POLLOCK.

J. H. OUTHWAITE & CO.,

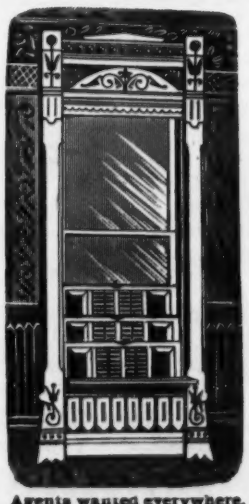
Exclusive attention given to

LAKE SUPERIOR AND MENOMINEE RANGE

Iron Ore,

Perry-Payne B'ld'g. Cleveland, O.

Hartman's Patent Inside Sliding Window Blind



is the most popular Blind in America. Architects & builders prefer it to any other, for merit, style, convenience and economy.

Not Complicated. The Only Blind that is furnish'd with an automatic Burglar-Proof Lock, free of charge. This is an item of immense magnitude, and may save you many times the cost of blinds & perhaps life also, and the only blind that gives entire satisfaction. Thousands are in use.

Agents wanted everywhere. Send for illustrated catalogue and prices. Manufactured by

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THE CONDIT-FULLER CO.,

Pig and Bar Iron,

CLEVELAND, OHIO.

E. C. POPE,

COMMISSION DEALER IN

Iron Ore, Pig Iron

AND METALS.

Cleveland, - Ohio.

Sam'l. L. Matner, Prest. & Treas. Fred. A. Morse, Sec'y.

Cleveland Iron Mining Co.,

Dealers in Iron Ores

from their own mines near Marquette, Lake Superior.

Rooms 4 & 5 Mercantile Bank Building,

CLEVELAND O.

MACHINERY SUPPLY MARKET.

Anvils.

American.....₩ lb 9@10
Wrights.....₩ lb 12

Bellows.

Blacksmiths' { Hill's.....dis 40
Bullock's.....dis 50&10
Moulders'.....dis 40@40&10
Hand.....dis 40&10@50

Belting.

Boston Belting Co's standard.....dis 70
" " " extra.....dis 60&5
" " " best.....dis 55
Hoyt's Short Lap.....dis 45
Cleveland Rubber Co. extra standard..dis 60&10
Shultz Raw Hide Leather Belting, single.....dis 40
Shultz Raw Hide Leather Belting, double, and Light Double.....dis 40
Standard, oak tanned.....dis 50&10
Alexander Brothers' pure oak tanned.....dis 45

Blowers and Exhausters.

B. F. Sturtevant's.....dis 20
Boston Blower Co.,.....dis 35
Buffalo.....dis 35

Borax.

.....₩ lb 12

Chalk.

White.....₩ gross 50
White Crayon.....₩ gross 12@12½ dis 10
Red.....dis 70
Blue.....dis 85

Chucks.

Cushman's 4 Jaw Independent.....dis 45
" Combination.....dis 40
" Geared Scroll.....dis 30
" 2 Jaw Brass Workers.....dis 30
" Drill.....dis 35
Wescott's Scroll Combination.....dis 33⅓
" Independent.....dis 40
" Little Giant Drill.....dis 30
Horton's Universal.....dis 40
" Independent.....dis 45
Whiton's Independent.....dis 45
National Combination.....dis 40
Sweetland " .....dis 40
Almond Drill.....dis 20
Morse " .....dis 15
Skinner's Combination Lathe.....dis 33⅓
" Independent Lathe.....dis 40
" Universal Lathe.....dis 40
" Drill.....dis 15

Cutters and Reamers.

Cleveland.....dis 10@15
Pratt & Whitney.....dis 10@15
Standard.....dis 10@15
Brown & Sharpe, Milling Cutters.....dis 15
" Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 4
Iron, steel points.....₩ lb 3½

Drill and Drill Sockets.

Twist drills.....dis 50&10
Morse Taper and Straight shank to 1¾".....dis 50&10
Morse Taper and Straight shank Larger than 1¾".....dis 25
Drill Sockets.....dis 25
Standard Twist Drills.....dis 55@55&5
Cleveland " " .....dis 55@55&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ₩ lb	4 c	5 c		2¾c
½ kegs ₩ lb	4¼c	5¼c		2¾c
¼ kegs ₩ lb	4⅜c	5⅜c		3 c
10 lb cans, 10 in case	6 c	6½c		5 c
10 lb cans, less than 10	10 c	10 c		7¾c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 45@50
H. H. Barton.....dis 50@50&10

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Sterling.....dis 60
Celluloid.....dis 10&33⅓
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 10&10

Files.

Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
Arcade.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50
ndustry File Works, hand cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Ilions Bolt Co. list.....dis 70

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4½	4	3½	3⅛
Hexagon	15⅝	11⅝	8½	6	5¾	5⅛	5
Washers	9	8	7	5	4½	4⅛	4⅛

In lots less than 100 lbs, ₩ lb add ⅛c., 1lb boxes add 1c to list.

Nails (wire.

List July 14, 1887.....dis 70 &10
Standard Penny Nails, ₩ keg card rate { Car lots.....$2.30 { Less than car lots $2.40

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $5.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 10@11
Russia Packing " .....₩ lb 14
Italian Packing " .....₩ lb 14
Plumbago Piston.....₩ lb 48
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 50
Sheet Rubber.....₩ lb 12&24
Excelsior Rubber.....₩ lb 48

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 45
Medart Pulleys.....dis 55
Split Wood Pulleys.....dis 50@55

Rivets.

Iron, Thousand, list November 17, ...dis 50
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50
Copper.....dis 50@50&10

Rope.

Manilla, ½ inch and over.....₩ lb 13¼
Sisal, ½ inch and over.....₩ lb 13¼

Sand Paper.

B. A. & Co.....dis 45@50
H. H. Barton's.....dis 40@45
New England Flint.....dis 40@50
Barton's Garnet.....dis 20

Saws.

Disston's Circular.....dis 40@10
" Band.....dis 10
" Scroll.....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Disston's.....dis 30
Atkins' Cicular Saws.....dis 40&45
" Mill, Mulay and Drag Saws..dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....dis 70c per ft
" Dexter Cross-cuts.....dis 50c "
" Diamond " .....dis 30c "
" Tuttle Tooth Cross-cuts..dis 25c "
" One-man Cross-cuts.....dis 32c "
No. 1 Handles.....dis 25c per pair
No. 6 " .....dis 16c "
Excelsior Saw Tools.....$6 per doz
Perfection " .....$15 "
Detroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay.....dis 45

Screws.

Wood Screws—New List 1890.

Flat head iron	dis 72½
Round head iron	dis 67½
Flat head brass	dis 72½
Round head brass	dis 65
Square Cap	dis 65
Hexagon Cap	dis 60
Set C. H. C. P	dis 70
Machine, flat head, iron	dis 65
Machine, round head, iron	dis 60
Bench and hand—	
Lag or coach	dis 75@75&10
Coach, patent gimlet point	dis 75

Shovels and Spades.

Ames' list November 1, 1885.....dis 20
Dennis.....dis 5.25
Hussey & Binns, railroad.....dis 8.00

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ½ lb Balls	21c@29c	
No. 18 " " ¼ and ¼ "	18c@26c	
No. 36 " " ¼ and ½ "	16c@27c	
2-Ply Hemp, ¼ & ½ lb Balls (Spring Twine	11½c	
3-Ply " 1lb Balls	12@12¼c	
3-Ply " 1½ lb Balls	11@11¼c	
Cotton Wrapping, 5 Balls to lb	15@16c	

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 15@20
Howard.....dis 35

Wire.

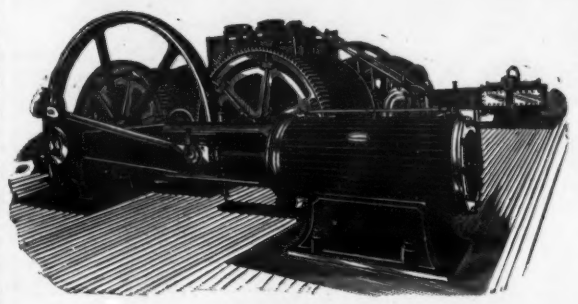
New List, Jan. 18, 1884

Brass and copper	dis 20@25
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis 65&5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	$6.00@lb dis 3

Wrenches.

Coe's genuine, ...dis 50
Girard Standard.....dis 70&10
Agricultural.....dis 75&10
Mechanics'.....dis 55&10,& 3
Bemis & Call's Combination .....dis 35
Donohue's Engineers.....dis 20&10
Lamson & Sessions Engineers.....dis 60
Billings & Spencer's Drop Forged.....dis 25
William's " " .....dis 25
Alligator " " .....dis 50

Webster, Camp & Lane Machine Co.



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Mining Machinery,

Improved Band Friction Hoisting Machinery, Geared or Direct Acting, for round or flat rope.

Wire Rope Haulage Machinery,

Endless or Tail Rope Systems.)

CORNISH PLUNGER AND BUCKET LIFT PUMPS.

Automatic or Slide Valve Steam Engines, Sheaves, Cages, Buckets, Etc.

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Oldest and Largest Manufacturers In the world.

VULCANIZED RUBBER GOODS

For Mechanical purposes.

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256-260 DEVONSHIRE STREET, BOSTON.

100 Chambers St., New York.
161 to 165 W. Pearl St., Cincinnati, Ohio.
148 to 150 Water St., Cleveland, Ohio
109 Madison St., Chicago, Ill.

THE THOS. D. WEST FOUNDRY. CO.

CLEVELAND. O.

LIGHT AND HEAVY

IRON CASTINGS.

DAILY MELTING CAPACITY 75 TONS-SPECIAL FACILITIES FOR ECONOMICALY TURNING OUT SMOOTH CLEAN CASTINGS.

DUPLICATE WORK A SPECIALTY

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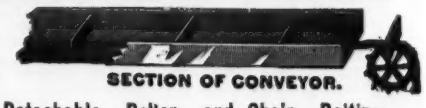
125 Champlain. Cleveland, O.

Steel Name Stamps (1-16, 3-32 or ¼ inch letters, 15c. per letter



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Detachable Roller and Chain Belting,

CHAIN.

MADE IN ALL SIZES OF

Malleable Iron and Steel,

DESIGNED FOR

Elevators, Conveyors, Drive Belts, etc.

For handling materials of all kinds.

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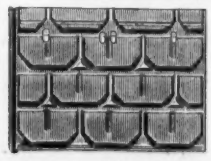
Eastlake Metallic Shingles.

Unequaled for

ROOFING AND SIDING.



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W. J. BURTON & CO.'s

Galvanized Iron Cornice Works,

Detroit, Mich.

Send for illustrated catalogue and prices.

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THE INDISPENSABLE LATHE DOG.

THE INDISPENSABLE LATHE DOGS can be attached to work after the work is centered in the lathe. They can be used equally as well BETWEEN COLLARS as upon plain or straight work.

DROP FORGED FROM BAR STEEL.

No. 1 takes from ¼ to 1¼ inches, price, each.....$1 50
" 2 " ½ to 2¼ " " 2 50
" 3 " 1 to 3¼ " " 3 50

Price, per set of three, to take from ¼ to 3¼ in. 7 50

PALMER, CUNNINGHAM & CO., L't'd,

607 Market St., PHILADELPHIA, PA.

IRON FOUNDRY CANTON IRON FOUNDRY CO., Canton, Ohio.

HEAVY AND LIGHT CASTINGS.

Privilege to make estimates solicited.

UNION ELECTROTYPE FOUNDRY

TELEPHONE 2199

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THE BRIGHTMAN STOKER IS THE BEST
STEAM BOILER FURNACE IN THE WORLD.
SEND FOR DESCRIPTIVE PAMPHLET. THE BRIGHTMAN STOKER Co. 201-203 RIVER ST. CLEVELAND, OHIO.

HARDWARE MARKET.

Augers and Bits.

Common augers and bits.....dis 70
Snell's.....dis 60&5
Cook's Douglass Mfg. Co.....dis 55
Russell Jennings' augers and bits.....dis 25
Expansive Bits, Clark's small, $18; large, $26.....dis 35@35&5
Hollow Augers, Ives'.....dis 25&10
Hollow Augers, Bonney's Adjust. ℔ doz., $48.....dis 40&10
Hollow Augers, Stearns' Adjust. ℔ doz., $48.....dis 20&10
Gimlet bits, common.....per gross $3 25@4 00
Standard Bit Stock Drills.....dis 50&10&5
Ship Augers.....dis 15&10@15&10&5

Axes.

Makers' and Special Brands—
First quality.....℔ doz $7 00
Others.....℔ doz $6 00
Full polished.....℔ doz $8 00

Bolts.

Cast iron barrel bolts.....dis 70
Cast iron shutter bolts, etc.....dis 70
Cast iron chain bolts.....dis 65&10
Ives' patent door bolt.....dis 60
Wrought iron barrel bolts.....dis 70
Wrought iron square bolts.....dis 70
Wrought shutter bolts.....dis 60&10
Sargent's list
Carriage, common, new list.....dis 75&10
Tire, common, new list.....dis 65
Carriage and tire, Philadelphia pattern.....dis 75&10
Stove bolts.....dis 60
Plow bolts.....dis 60&5
Machine.....dis 75&10@80
Ends.....dis 75&10&80

Buckets, Elevator.

.....dis 50&10

Butts.

Wrought brass.....dis 75&10
Cast brass, loose joint.....dis 33⅓
Cast Iron—
Fast joint, narrow.....dis 50&10&5@60
Fast joint, broad.....dis 50&10@60
Loose joint.....dis 70&10
Loose joint, jap.....dis 70&10
Loose joint, jap. with acorns.....dis 70&10
Loose pin, acorns.....dis 70&10
Loose pin, japanned acorns.....dis 70&10
Loose pin, acorns, jap. plated tips.....dis 70&10
Wrought steel—
Wrought, fast joint, narrow.....dis 70&10
Wrought, fast joint, broad.....dis 70&10
Wrought, loose joint, broad.....dis 70&10
Table Butts, back flaps, etc.....dis 70&10
Regular inside blind.....dis 70&10
Light inside blind.....dis 70&10
Loose pin.....dis 70&10
Light loose pin.....dis 70&10

Carbonized Felt and Building Papers.

(POWERVILLE BRAND.)

	Per roll of 500 sq. feet.
Eberts Bros., Detroit.	
No. 1—Slaters'	$1.25
"A," Stringed Roofing, Light.	1.50
"B," Stringed Roofing, Medium	1.75
"C," Stringed Roofing, Heavy	2.00
Stringed, Rosin-Sized	1.00

MILCELLANEOUS.

Asphaltum, Trinidad Refined, ℔ ton	$30.00
Asphaltum, Fine Grade, ℔ lb	.08
Coal Tar Felt, 1 Ply, ℔ lb	.02
Coal Tar Felt, 2 Ply, ℔ roll 108 sq ft	1.42½
Coal Tar Felt, 3 Ply, ℔ roll 108 sq ft	1.85
Roofing Pitch, ℔ gal	.09

Chains.

Revised List.

Trace, 6¼-10-2.....℔ pair 1.05
Trace, 6¼-10-3.....℔ pair .92 .....50&10
Trace, 7-10-2.....℔ pair 1.11
German Halter Chain, list June, 1887...dis 50&10
German Coil, list of June, 1887.....dis 50&10@60
Galvanized Pump Chain.....℔ 05¼@6
Jack Chain, Iron.....dis 75&10
Jack Chain, Brass.....dis 75

Chisels.

Socket Framing and Firmer.....dis 75
Socket Framing and Firmer, Buck Bros..dis 30
Socket Firmer and Framing, L. & I. J. White.....dis 30@30&5
Tanged Firmers.....dis 40&10

Cutlery.

Table.....net
Excelsior Pocket.....net

Fibre Ware—Standard.

	Nos. 1	5.	5X.
Pails, water, 12 qt	$4 00	$4 50	$.....
Dairy, 14 qt	4 50	5 00	.....
Fire 12 qt	5 00	.....	.....
Sugar	6 00	6 50	.....
Horse	.....	5 00	.....
Buggy	4 00	.....	.....
Chamber } 5 and			
Slop } 5X	6 50	7 50	8 50
Commode } 14 qt.			
Mrs. slop, 5 and 5X 14 qt	8 00	9 00	10 00
Basins, wash—			
10½ inch	2 00	2 25	.....
12 inch	2 25	2 75	3 25
13½ inch	2 75	3 25	3 75
15 inch	3 25	3 75	4 25
Bowls, fruit	.....	2 50	.....
Servers, 12 in	.....	2 25	.....
Baskets, waste paper, 13 in	.....	6 00	.....
Spittons, "Daisy," pressed			
8 inch	4 00	4 50	5 00
10 and 11½ inch	6 00	6 50	7 50

No. 1 plain; No. 5 decorated; No. 5X White decorated.

Gimlets.

Nail and Spike.....dis 50&10&5
Double cut, low list.....dis 25
"Bee".....℔ gross $12, dis 25@25&5

Hanger

Barn door, old patterns.....dis 60&10&10@70
Climax, (Anti-Friction).....dis 55
Scranton.....dis 33—
Kidder's.....dis 50&10@60
Terry's Patent.....5 in., $12; 4 in., $10, dis 50&5
Paragon.....dis 40&10
Richard's.....dis 30@30&10

Horse Nails.

No.	10	9	8	7	6	
Ausable, ℔ M	23	24	25	26	28	dis 40
Putnam, ℔ M	18	19	20	21	23	dis 15
Essex						dis 25&10

Horse Shoes.

Burden, at factory.....℔ keg $4 00
R. I. Horshoe Co., Perkins' Imp. at factory.....℔ keg $4 00
Mule Shoes, at factory.....℔ keg $5 00

Knobs.

Carriage, japanned.....℔ gross 80c dis 60&10
Base, rubber tip.....dis 70&10&5
Hemispite door knobs, new list.....dis 40&10@50
Door mineral.....dis 65c@68c
Door Por. japanned.....dis 75c@78c
Door Por. nickle.....$2 00@2 25
Door Por. plated.....$2 00@2 25

Locks, Bolts, Etc.

P. & F. Corbin, Locks and Bronze Goods.
Door locks, knobs and latches.....dis 60&10
Escutcheons and keys.....dis 60&10
Padlocks and padlock keys.....dis 75
Bell pulls, mineral, porcelain and jet dis 60&10
Bell pulls, genuine bronze.....dis 60&10
Lever bell pulls, genuine bronze.....dis 60&10
Butts', genuine bronze.....dis 60&10
Butts' bronze plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges&flaps, genuine bronze.dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronze.....dis 70
Shutter knobs, genuine bronze.....dis 50
Shutter bars, genuine bronze.....dis 60
Sash lifts, genuine bronze.....dis 60
Sash pulls and plates, genuine bronze.....dis 60
Push plates, genuine bronze.....dis 60
Drawer pull, genuine bronze.....dis 70
Letter box plates, genuine bronze.... dis 60&10
Barn door locks.....dis 33⅓
Bishop's Buckeye Sash Locks.....℔ gross $4.80

Plumbs and Leve s.

Standard list.....dis 70&10
Pocket levels.....dis 70&10
Davis' inclinometers.....dis 10&10

Pumps.

Cistern, best makers.....dis 50&10@60
Pitcher spout, best makers dis 60&10@60&10&10
Pitcher spout, cheaper goods.....dis 70@70&5

Pokes, Animal.

Bishop's I. X. L.....℔ doz $6 00
Bishop's O K.....℔ doz $5 25
Bishop's Pioneer.....℔ doz $3 75
Bishop's American.....℔ doz $2 75

Rakes.

Cast steel.....dis 70
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 20
Wostenholme & Butcher.....$10@$...dis 10
Rifle razor.....dis $9 50 net

Rat Killers.

Schuyler's.....℔ gross $15 00

Scales.

Hatch, Counter, No. 171.....℔ doz $21 00
Hatch, Tea, No. 161.....℔ doz $6 75@7 00
Chatillon's Grocers.....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882.....dis 50&10@50&10&4

Screw Drivers.

Stanley R. & L. Co.'s Varnished Handles.....dis 65&10
Stanley R. & L. Co.'s Black Handles..dis 60&10
Sets interchangeables.....℔ doz $18 dis 25

Squares.

Steel and iron } dis 75&10@80
Nickel plated }
Disston's try square and T bevels.....dis 45&10
Winterbottom's try and miter.....dis 40&10

Tacks, Brads, Etc.

New List, Oct. 19, 1890.

American iron carpet tacks all kinds dis 77½&10
Steel carpet tacks all kinds.....dis 75&10
Swedes iron carpet tacks, all kinds dis 75&10
Swedes iron tacks.....dis 75&10
Swedes iron Upholsterers' tacks.....dis 75&10
Tinned Swedes iron tacks.....dis 77½&10
Tinned Swedes iron Upholsterers' tacks.....dis 77½&10
American iron cut tacks.....dis 77½&10
Copper tacks.....dis 40&10
Copper finishing and trunk nails.....dis 50&10
Cigar box nails.....dis 50&10
Finishing nails.....dis 60&10
Hungarian nails and miners' tacks...dis 60&10
Gimp and lace tacks.....dis 77½&10
" " " tinned.....dis 60&10
Trunk and clout nails.....dis 72½&10
Tinned trunk&clout nails.....dis 66&10
Basket nails.....dis 66&10
Chair nails.....dis 66&10
Common and patent brads.....dis 66&10

FREIGHT AND PASSENGER
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L. S. GRAVES & SON,
Main Office and Works, ROCHESTER, N. Y.
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DETROIT, Hodges Building.
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PACKING, BELTING, HOSE, GASKETS, ETC.
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AGENTS
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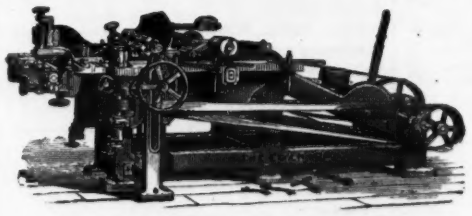
Builders and Originators, Designers and Constructors.
Wood-Working Machinery.



New "Standard" Molder, Four Sided.
4, 6, 7, 8, 9, 10 and 12-inch.
Geared feed rolls, two above and two in table. Slotted steel heads.

For Every Purpose
Meeting the requirements of
PLANING MILLS,
SASH, DOOR and BLIND FACTORIES,
PATTERN SHOPS,
General Wood-workers etc.
With the latest and most advanced type of machines for fast and perfect work.
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CLEVELAND, OHIO.

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ORDER DIRECT FROM THE
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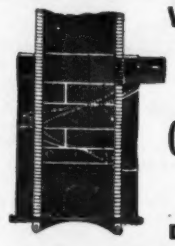

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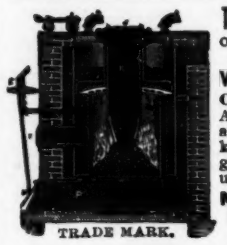
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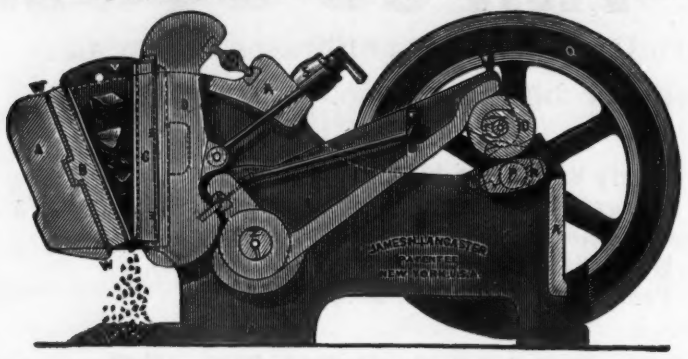

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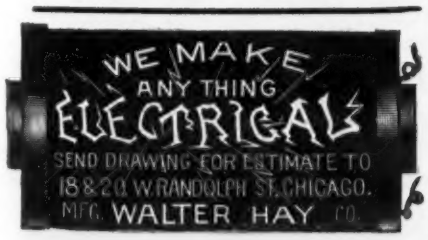

TRAVELERS' REGISTER.

Standard Time.

Erie Railway.

Depot, South Water Street and Viaduct.

	Arrive.	Depart.
N. Y. & Pitts. Express.....	‡5 38 a m	*8 25 a m
Fast N. Y. & Pitts. Express*	10 55 a m	*3 00 p m
Mahoning Accommo.....		†6 40 a m
Pittsburgh Express.....	†6 25 p m	
Youngstown Local.....	†8 05 a m	
Mahon'g div. & Pitts Local		*11 40 a m
Mahoning Val. Accom.....		†4 30 p m
Pittsburgh Express.....	‡1 20 p m	11 10 p m
New York Express.....	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.

(Standard Gauge.)

Depart for—

Zanesville and Coshocton—6:50 a. m., 3:00 p. m.
Canton—6:50 a. m., 3:00 p. m., 6:20 p. m.
Kent—6:50 a. m., 3:00 p. m., *5:45 p. m. 6:20 p. m.
Bedford—6:50 a. m., 11:10 a. m., 1:30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m. 10:35 p. m.
Newburgh—6:15 a. m., 6:50 a. m., 11:10 a. m., 1.30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m., 10:35 p. m.

Arrive from—

Zanesville and Coshocton—10:30 a. m., 6:30 p m.
Canton, 10:30 a. m., 2:35 p. m., 6:30 p. m.
Kent—*8:10 a. m., 10:30 a. m., 2:35 p. m., 6:30 p.m.
Bedford—6:00 a. m., *8:10 a.m., 10:30 a.m., 1:05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p.m., 7:10 p.m.
Newburgh—6:00 a. m., 7:15 a. m., *8:10 a. m., 10:30 a. m., 1.05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p. m., 7:10 p. m.
Trains marked * run daily.

Valley Railway.

FOR AKRON, CANTON AND MARIETTA.

Depot oot South Water Street.

	Depart.	Arrive.
Valley Junction Mail.....	*7 25 a m	*6 40 p m
Marietta Express.....	†11 15 a m	†2 35 p m
Balto. & Wash. Express....	*4 00 p m	*10 25 a m
Cleve. and Canton Express	†6 30 p m	†8 15 a m

*Daily. †Daily, except Sunday.

J. T. JOHNSON, Gen. Supt. J. B. CAVEN, Gen. Pass. Agt.

From Cleveland Union Station.

PENNSYLVANIA LINES.

Cleveland & Pittsburgh R. R.

	Depart.	Arrive.
For Pittsburgh, Baltimore, Washington, Philadelphia and New York.	7 45 a m	d5 25 a m
	1 15 p m	12 50 p m
	d11 10 p m	6 35 p m
Wheeling and Bellaire.	7 45 a m	12 50 p m
	1 15 p m	6 35 p m
	*11 10 p m	.....
Alliance Accom.....	3 25 p m	10 10 a m
Ravenna Accom.....	5 00 p m	8 25 a m

d Daily. *Except Saturday. Other trains except Sunday.

From Cleveland Union Station.

Mt Vernon and Pan Handle Route

Cleveland & Pittsburgh R. R.

	Depart.	Arrive.
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon, Columbus, Xenia, Dayton, Cincinnati, Louisville, Indianapolis, St. Louis, and all points in the South and Southwest.	8 00 a m	d 7 00 am
	d 8 00 p m	5 40 p m
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon and Columbus.	1 15 p m	12 50 p m
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	3 25 p m	10 10 a m

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	Depart.
No. 62, Accommodation.....	† 6 00 a m
No. 72, New York & Pitts. Express....	* 8 10 a m
No. 70, Pittsburgh Accom.....	*11 25 a m
No. 64, New York & Pitts. Limited...	* 2 50 p m
No. 66, Mantua Accommo.....	* 4 20 p m
No. 74, Youngst'n Ex.....	† 6 00 p m
No. 68, New York & Pitts. Ex.....	*11 00 p m
	Arrive.
No. 61, N. Y. & Pittsburgh Express...	† 5 15 a m
No. 71, Youngstown Accom.....	* 7 15 a m
No. 65, New York & Pitts. Lim.....	* 9 55 a m
No. 67, Pittsburgh Accom.....	*12 30 p m
No. 73, Leavittsburgh Local.....	* 2 10 p m
No. 63, New York & Pitts. Ex.....	* 6 50 p m
No. 75, Mantua Accom.....	* 7 20 p m
No. 69, Youngstown Express.....	† 9 10 p m

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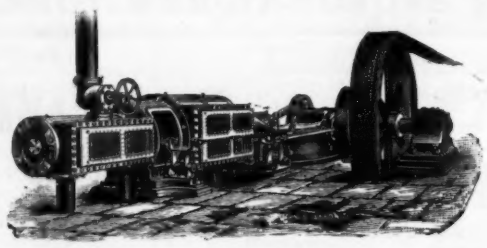

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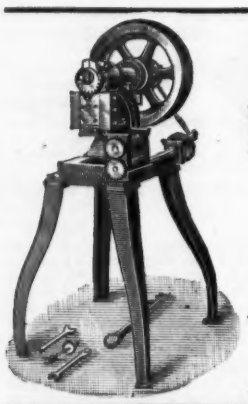

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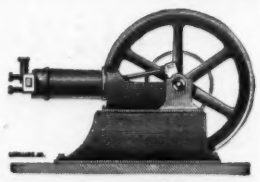

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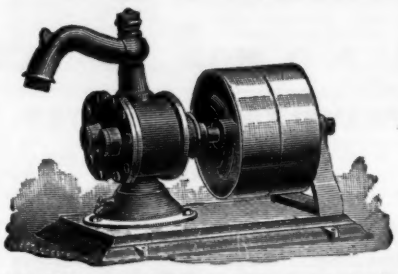

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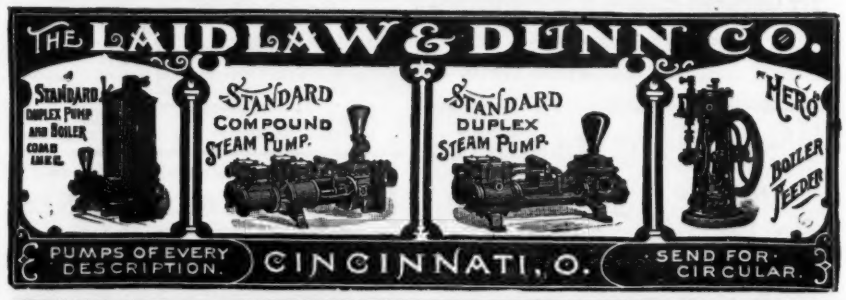

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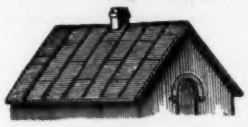

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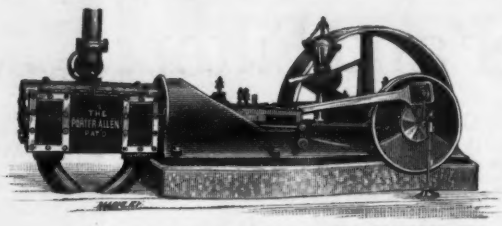

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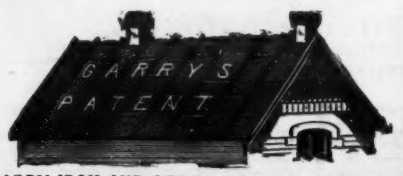

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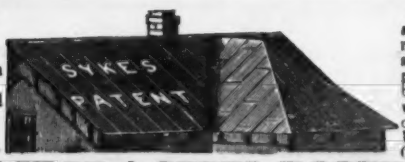

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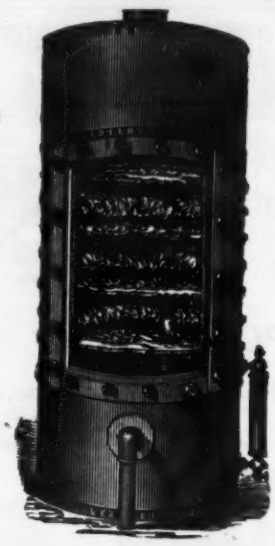

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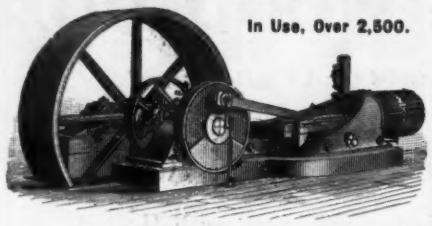

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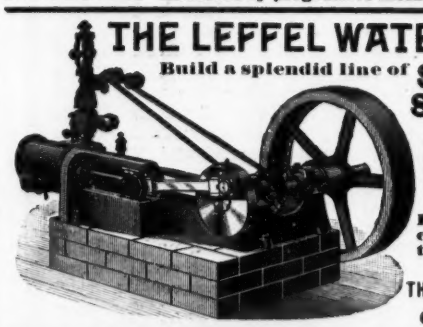

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